

PORPHYRY'S COMMENTARY
ON PTOLEMY'S
HARMONICS

A Greek Text and Annotated Translation

ANDREW BARKER



PORPHYRY'S COMMENTARY ON PTOLEMY'S *HARMONICS*

Porphyry's *Commentary*, the only surviving ancient commentary on a technical text, is not merely a study of Ptolemy's *Harmonics*. It includes virtually free-standing philosophical essays on epistemology, metaphysics, scientific methodology, aspects of the Aristotelian categories and the relations between Aristotle's views and Plato's, and a host of briefer comments on other matters of wide philosophical interest. For musicologists it is widely recognised as a treasury of quotations from earlier treatises, many of them otherwise unknown; but Porphyry's own reflections on musical concepts (for instance notes, intervals and their relation to ratios, quantitative and qualitative conceptions of pitch, the continuous and discontinuous forms of vocal movement, and so on) and his snapshots of contemporary music-making have been undeservedly neglected. This volume presents the first English translation and a revised Greek text of the *Commentary*, with an introduction and notes designed to assist readers in engaging with this important and intricate work.

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At one stage in the slow progress of my work I was thinking of cutting it short and only publishing translations of selected passages of the *Commentary*; and when I mentioned the possibility to Geoffrey Lloyd, it was his horrified reaction to this pusillanimous strategy that spurred me into pressing on. During the project's later years I had the privilege of working with Massimo Raffa on his Italian translation of the text, which will probably appear at about the same time as mine. I learned a great deal from him in the process; he opened up some fascinating fresh perspectives on Porphyry's arguments, and alerted me to a number of textual and interpretative difficulties I had missed. Stefan Hagel's persistent questioning of the ways in which I construed certain passages compelled me to rethink and sharpen my interpretations, and he gave invaluable guidance about the puzzles presented by one particularly problematic chapter. Others to whom I am indebted for advice and encouragement include David Sedley, Malcolm Schofield, Angelo Meriani, Eleonora Rocconi and David Creese. Those whom for various reasons I cannot name include many members of my audiences who have commented and raised questions about papers I have presented at conferences and seminars in Europe and the United States, and the two anonymous readers for Cambridge University Press,

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Introduction

I Porphyry's life and writings

Almost everything we know about Porphyry's life comes from remarks of his own, scattered here and there in his biography of Plotinus (*Vita Plotini*). The short account in Eunapius' *Lives of the Sophists*,¹ effusive though it is in Porphyry's praise, adds little of any substance, and few other writers tell us anything at all. We know that he was born in Phoenicia in AD 233 or 234, perhaps in Tyre, where he was brought up.² As a young man he studied for several years in Athens, mainly with Longinus, the most distinguished literary scholar and critic of his generation (Eunapius describes him as 'a living library and a walking shrine of the Muses'). Longinus was also a respected philosopher, the leading exponent and interpreter of Platonism in Athens.

In 263/4, at the age of thirty, Porphyry joined the circle of Plotinus in Rome, a city humming with cultural and intellectual activity. Plotinus and Longinus disagreed on substantial issues, and the former apparently regarded the latter as a philosophical light-weight, 'a man of letters but in no way a philosopher'.³ Possibly Porphyry had already formed a similar impression, but his move to Rome cannot have been motivated by a conviction that Plotinus' philosophical opinions were correct. He was not yet familiar with his opinions, let alone persuaded by them; he tells us that he misunderstood Plotinus' lectures when he first heard them, and wrote

¹ *Vit. soph.* 455–7 in Boissonade's 1822 edition; his pagination is reflected in the marginal numbers printed in the Loeb edition (Wright (1921)).

² His original name was Malchos, meaning 'king' in the local language. According to Eunapius it was Longinus who gave him the Greek name Porphyrios, 'purple' or 'crimson', with an eye to the colour's regal connotations (and perhaps also to the shared Phoenician origins of both Porphyry and the famous purple dye). He evidently adopted it as his regular name. Some of his colleagues in Rome called him Basileus, the standard Greek term for a king or emperor, but this was probably just an affectionate nickname used by his friends, including Longinus himself (*Vit. Plot.* 21), after Porphyry had moved from Athens to Rome.

³ *Vit. Plot.* 14. For Longinus' views on Plotinus and others see *Vit. Plot.* 19–21.

an essay trying to demonstrate that his views on one important issue were wrong. It was only after a series of written exchanges with Plotinus' most faithful and long-standing associate Amelius that he finally grasped the force of Plotinus' reasoning and the truth of his conclusions (*Vit. Plot.* 18).

Porphry stayed with Plotinus for six years; they became close friends, and Plotinus entrusted him with the task of revising his writings for publication (*Vit. Plot.* 7). He devoted himself to the project after his master's death. It cannot have been an easy matter. Plotinus' eye-sight was poor, and Porphyry had to cope with his sprawling handwriting, with his carelessness over spelling and other elementary points of presentation, with problems of sense and coherence arising from his refusal to re-read and polish anything he had written, and with the fact that the corpus was an enormous mass of disconnected essays bundled up in no intelligible order. It seems quite likely that Plotinus chose Porphyry as his editor as much for his literary skills and sensibilities – honed, as presumably they were, during his time with Longinus – as for his philosophical acumen.⁴ But whatever his reasons were, Plotinus chose well, at least in picking an editor who would not shirk his responsibilities. The outcome is the work we know as the *Enneads*.

By the end of his first six years in Rome Porphyry faced a personal crisis whose exact nature and causes we do not know, and from his brief statements in *Vit. Plot.* 11 we might infer that he did not know them himself. A modern doctor might have diagnosed his condition as clinical depression. He was contemplating suicide, but Plotinus dissuaded him, advising him that he might recover his zest for life if he left Rome for a time. He took the advice and travelled to Sicily, where it seems that he found that Plotinus (as always) had been right.

News of Plotinus' death (AD 270) reached him there a few months later. Whether he went back to Rome immediately or extended his absence is unclear, nor can we be sure whether he inherited the headship of a formally established 'school' from Plotinus on his return; but he evidently came to be recognised as the leading figure among Plotinus' followers and as the foremost philosopher in the city. Apart from the record of his copious writings and his work on the material Plotinus had left, we know few details of this phase of his career except that he married a friend's widow, Marcella, to whom one of his essays is addressed. (According to Eunapius,

⁴ Eunapius writes in glowing terms of the clarity and beauty of Porphyry's style. He himself is no stylist and he may be an unreliable judge; and no one reading Porphyry's surviving works now will find these virtues on every page (they are conspicuously absent from much of the commentary translated here). But at certain points in his writings (in passages of the *ad Marcellam*, for instance, and in some of the longer *Sententiae*) we may be able to see what Eunapius had in mind.

he married her to ensure that his friend's numerous children should be given a good education.) The *Life of Plotinus* was published in AD 301 or shortly afterwards, and Porphyry probably died only a little later, but our information is not very precise. Eunapius tells us only that he reached 'an advanced old age'. The *Suda* is a little more helpful, saying that he lived 'into the time of the emperor Diocletian', which probably means that he died before AD 305 when Diocletian abdicated. If we use that as a marker, Porphyry was about seventy years old when he died. But Diocletian lived on for another seven years or so, and it is possible, though much less likely, that the *Suda's* source reckoned 'the time of Diocletian' as ending only with his death.

Fifteen of Porphyry's works survive either complete or as incomplete texts containing a large proportion of the whole, and we also have a substantial body of shorter fragments.⁵ On the basis of cross-references in Porphyry's own surviving writings, and of the treatise titles, quotations and reports provided by later authors, recent scholars have tried to establish the number of works that he actually wrote; the highest estimate I have come across is 81 and the lowest is 59.⁶ They included essays on metaphysical issues, incorporating influential developments of thought beyond the doctrines of Plotinus and perhaps sometimes in conflict with them; commentaries on Aristotle's treatises in logic, metaphysics, physics and ethics; commentaries on several of Plato's dialogues; a history of philosophy from its beginnings to Plato; various other historical writings; commentaries on the Homeric poems, and essays on other philological topics; a large number of works on religious traditions and rituals; and a handful of pieces on technical subjects, one of which is his commentary on Ptolemy's *Harmonics*.

2 The commentary on the *Harmonics*: General profile

Porphyry presents his work as a 'commentary' in the strict sense of the word.⁷ After a brief but thought-provoking introduction he works his way systematically through Ptolemy's text in its original order, usually prefacing each phase of his discussion with a lemma quoting the passage of the *Harmonics* which it is designed to elucidate, and in most cases

⁵ For the most authoritative collection of fragments see Smith (1993).

⁶ The higher estimate is that of Romano (1979): 217–21. The more conservative and more recent assessment is that of Smith (1993): 1–LIII (he adds six others which in his view are certainly or probably spurious).

⁷ The most important MSS include the regular term for a commentary (*hypomnēma*) in its title. In his introduction Porphyry refers to it as an *exēgesis*, an 'exposition' or 'explication' (3.17, 4.24, 5.18, cf. 4.23).

the successive lemmata leave no gaps in Ptolemy's text.⁸ Porphyry plainly intended his commentary to cover each chapter of the *Harmonics* in full and to respect the continuity of its arguments; it was not designed merely as a set of reflections on selected excerpts.

He says in his introduction that he will aim, for the most part, at 'due proportion' (*symmetria*) in his dealings with the text (4.22–4). He can hardly mean that he will make the length of his discussions proportionate to that of the passages they address, since in this respect his treatment of the lemmata is very uneven. A single sentence may provoke several pages of comment, while much longer passages attract only a cursory glance. He must mean that the length and depth of his discussions will be governed by his estimate of the importance of the passages they consider and that of the issues they prompt him to examine, and in that case their length, and perhaps also their degree of complexity, depends as much on his own intellectual interests and priorities as on Ptolemy's. This point will clearly have a bearing on the fact that while the disparities in his treatments of passages within any one chapter are rarely obtrusive or surprising, there is a striking imbalance between his discussions of the earlier and later parts of Ptolemy's text. The commentary runs to 172 pages in Düring's edition and covers 55 pages (22 chapters) of the *Harmonics*. But by the end of I.4, after dealing with eight of Ptolemy's pages, 87 pages of the commentary have gone by and we have passed the half-way point; and for the text of I.5–I.8 (a little over nine pages in Ptolemy) there are 34 pages of commentary. At the end of I.8 we are already more than two thirds of the way through the commentary, with only 51 pages left for the remaining 14 chapters (about 38 of Ptolemy's pages).

Some sections of the commentary are swollen by another of its most striking features, that is, its profusion of quotations from earlier writings. Several of them are very long, substantially increasing the length of the sections in which they appear, and by far the majority of them appear in the commentary's first few chapters.⁹ The longest single quotation runs from 67.24 to 77.18, nearly ten pages in Düring's edition; it forms part of the twenty-two-page commentary on *Harm.* 9.6–15, which incorporates about seventeen pages of quotations. This is an exceptional case; many

⁸ But there are certain omissions. On this matter and other issues to do with the lemmata see Section 10 below.

⁹ The flood of quotations dwindles to a trickle after I.5. In I.6–7 there are just a few lines of quotation, and I.9 and I.12 contain about half a page each. No quotations appear in I.8 or I.10–11, and in the ten chapters from the beginning of I.13 to the end of II.7, where the commentary breaks off, there are none at all.

of Porphyry's quotations are only a few lines long, and only a handful cover more than a couple of pages. But there are a great many of them, mostly from works by philosophers or musical theorists, but also from mathematicians, natural scientists, grammarians and other scholars and occasionally from poets.¹⁰ Porphyry makes a point of saying plainly in the introduction that he intends to make use of what his forerunners had said; he will not try to pass off these borrowings as his own, as some writers had done, but will conscientiously name the authors whose work he transcribes (as indeed he does, with very few exceptions). He denies that the practice should be held against him as plagiarism, defending it on the grounds – all the more piquant now, in a world where the internet is king – that what has been written, and especially what has been well said, is public property available for everyone's use (4.24–5.16).

The more one examines these quotations and their contexts, the clearer it becomes that they are not there merely for their antiquarian interest, or to show off Porphyry's extensive learning, or to conform to an established canon of conventions like those governing a modern Ph.D. thesis, or simply to save time, as he rather naively puts it at 4.25–6. On the contrary, they contribute substantially to his arguments, exemplifying and adding detail to the points that currently concern him, developing the grounds for his conclusions, setting them in the context of ancient and on-going debates, playing different authors off against one another, and sometimes (as notably in his quotations from Plato and Aristotle at 46.5–13 and 47.15–23) providing a springboard from which he can launch himself into controversial territory. At the end of the same passage, he uses long quotations from Theophrastus and Panaetius (61.22–67.10) to give additional authority to the contentious conclusion he has reached. Although he does not always directly explain their bearing on the issues in hand, it turns out on inspection that in almost all cases the quotations have been carefully integrated into his agenda at appropriate moments, and contribute intelligibly to his line of thought.

We cannot be sure when the commentary was written. In view of its huge collection of quotations we can certainly say that wherever Porphyry was when he wrote it, he had a well-stocked library at his disposal; but that would be the case whether he was in Athens or in Rome, though perhaps not in Sicily. So far as the musicological content of the work is concerned, it might have been composed at any time in Porphyry's life, and almost

¹⁰ I have not tried to quantify the total amount of quotation exactly. But on a rough count it amounts to about forty-three of Düring's pages, a quarter of the commentary's length.

all the philosophical indications can be taken to point either backwards to pre-Plotinian Platonism or forwards to the works of Porphyry's maturity, into which he absorbs as much from Middle Platonist writers as he does from Plotinus himself. Its lack of literary polish, except in a few isolated passages, might incline us to doubt that Porphyry wrote it while he was still under the influence of Longinus in Athens; but style is an uncertain guide, and the elegance desirable in a free-standing, discursive work may not have seemed necessary or appropriate in a commentary on a technical treatise.

But the text gives one fairly clear pointer to a date in the later part of his career. At 115.27–116.1, referring to the scale constructed in Plato's *Timaeus*, he says that he gives an explanation of its exceptionally large compass in other writings. This is not a promise of some future enterprise; his 'we give' is in the present tense, implying that the writings already exist. It must almost certainly refer to his commentary on the *Timaeus* (now surviving only in fragments), and this is most unlikely to have been an early work. In any case my own opinion, for what it is worth, is that the commentary is not a piece of juvenilia. It is the work of a mature philosopher with many years of dedicated scholarship and reflection behind him (see further Sections 6 and 7 below). He draws freely, as we have seen, on the writings of earlier philosophers, especially Plato and Aristotle, and of mathematicians and other scientists as well as specialists in musical theory, offering perceptive interpretations and deploying them judiciously in the service of his project; and at least on philosophical issues he presents his own independent contributions with confidence and flair. Although he has less of his own to offer when he focuses on more specifically musicological matters, what he does contribute is carefully considered and by no means negligible.

The commentary has not been translated into English before, but translations, it appears, behave much like London buses; after long stretches of time in which there's no sign of any at all, several turn up at once. Just so, this translation coincides almost exactly with another, an Italian translation by Massimo Raffa.¹¹ Perhaps this is not just a coincidence. Specialists in ancient Greek musical theory have often drawn on this text, though almost always for its quotations from other sources, and in recent decades their subject has ceased to be the preserve of a handful of eccentrics; there are very many more of us now. Over the same period the study of Greek philosophy in later antiquity has also moved from the fringes into the main stream,

¹¹ For his previous translation of Ptolemy's *Harmonics* see Raffa (2002).

and the rich philosophical reflections in the first few chapters of Porphyry's commentary have attracted considerable attention. In the same time-frame the study of ancient commentaries in general has made great progress, due especially to the work of Richard Sorabji and his collaborators, who have published a massive array of translated ancient commentaries on Aristotle.¹² It rather looks as if this commentary's time has come.

3 The commentary as a fragment

The commentary is not complete. Two pieces are missing, one short and one very long, and in both cases we should try to decide whether they were lost at some early stage in the process of transmission, or whether we do not have them because they were never written. The shorter passage is at the end of Book I; each of Ptolemy's three Books had sixteen chapters, and there is no commentary on I.16. That might, in principle, be for any of four reasons: the text of Ptolemy available to Porphyry might have lacked this chapter; or he might have found nothing in it that he thought worth discussing; or he might have postponed the task in order to do further research before tackling it but never in fact returned; or he wrote it and it was subsequently lost.

The first of these possible reasons can be dismissed immediately. Porphyry refers to the content of Ptolemy I.16 in the course of his discussion of II.1 (which deals with aspects of the same topic from a different angle), and it is clear that he knew it. The second is initially tempting. Ptolemy's chapter moves away from the theoretical derivations of scale-structures with which he had previously been occupied. It tells us that with just one exception they do not reappear in their theoretically unadulterated forms in music that is actually performed, and that some of them are not found there at all; and it explains how those of them that contemporary musicians used were combined and sometimes modified in their patterns of attunement. Together with the later passages which complete his account of these attunements (II.1 and II.16), it is of great interest to students of ancient musical practice, but one might suppose that an abstractly minded philosopher would have found nothing in it to whet his appetite. But this will not do. For one thing, there are certainly philosophical questions to be raised about the extent to which Ptolemy's manipulation of his theoretical results in this chapter is consistent with his previous declarations about scientific

¹² Sorabji (1989–). Over sixty volumes have been published to date, and the series continues to grow. See also Sorabji (1990).

methodology. Again, Porphyry had already worked his way through seven chapters in which he had scarcely fluttered his philosophical wings, and would doggedly continue to do so through parts of Book II; he is unlikely to have abandoned his task in this isolated case. More conclusively, he addresses Ptolemy's second visit to the subject in II.1 with enthusiasm and at considerable length (introducing modifications which have posed severe problems for modern interpreters; see Section 5(c) below), and he clearly assumes that his readers are already familiar with the content of his missing chapter. Hence the second possible reason must be rejected. The third remains hypothetically feasible, though the considerations that undermine the second make it fairly improbable, and I would judge that the fourth is almost certainly correct: the commentary on this chapter was written but was subsequently lost. This hypothesis gains support from defects in the manuscript texts at the end of the preceding chapter, I.15, which not only leave minor uncertainties and lacunae but also lack any comments on the final sentences of Ptolemy's discussion. Further, if I.15 originally ended at the point where our text of the chapter runs out, and if that were also the end of the whole commentary on Book I, we would expect to find appropriate indications in those of the MSS that mark chapter-endings elsewhere; but there are none. It seems probable, then, that the last lines of the commentary on I.15 have been lost, and that Porphyry's discussion of I.16 was lost with them.¹³

The long omission is less easily explained. In its surviving form Porphyry's commentary breaks off at the end of II.7, leaving nine further chapters of Book II and the whole of Book III untouched. The absence of any discussion of Book III is especially regrettable. We could have learned much from Porphyry's reflections on the philosophical musings of III.3, and on the subsequent chapters in which Ptolemy puts harmonic theory to work in the service of human psychology and the study of the heavens. He could also have preserved valuable information about the content of Ptolemy's last three chapters, which were wholly or partly lost at an early stage of the text's transmission and of which we now have only the reconstructions offered by Byzantine editors.

We shall probably never know whether Porphyry completed his commentary or not. One day some lucky Egyptologist might conceivably stumble on a hoard of papyri that would settle the question, but as things stand we have no evidence – or at least no evidence outside the commentary

¹³ In this connection an anonymous reader makes the point that the MSS also omit the ends of all Proclus' lemmatic commentaries on Plato.

itself – to support any judgement at all. Internal evidence cannot give us a definite answer (there are, for instance, no references forward to any part of the commentary after II.7, which might at least have clarified Porphyry's intentions), but it makes me lean tentatively to the view that he abandoned the task or put it aside in favour of other projects. Perhaps he intended to come back to it one day, but in the event he never did so. By the point at which the text runs out he had already laboured through a long series of technically demanding chapters in which he had found little fuel for independent thought, and there were a dozen more in a similar vein to come before he could emerge into the philosophically alluring uplands of III.3 and its sequels. It would not be very surprising if he lost his appetite for the task and left it unfinished; even the almost indefatigable Porphyry might have found it too wearisome to contemplate. There is also another, perhaps more compelling reason why he might have thought it pointless to continue, but I must postpone it until we have considered his purposes in writing the commentary (Section 7 below). None of this comes anywhere near to proving my hypothesis, of course. Maybe he soldiered on to the end, and the later parts of the manuscript from which all ours are derived were mislaid by a careless librarian.

4 The philosophical content of the commentary

Porphyry is not known for any other works on music or musical theory.¹⁴ His interests spanned a wide range, but he was above all a philosopher, and it is primarily as a philosopher that he addresses Ptolemy's text.¹⁵ The genre of commentary had long been established as the most important vehicle for original philosophical and philological thought, a fact that observations by David Sedley may do much to explain (he is initially referring to the way in which Stoics in the first century BC treated an outdated thesis propounded by Zeno of Citium). 'Now, such was the commitment in philosophical schools to the truth of the founder's word that subsequent Stoics could not simply disown this argument and its implications. Philosophical debate within schools was presented as recovery and interpretation of the founder's

¹⁴ He certainly discussed the musical construction of the World Soul in his commentary on the *Timaeus*; see Procl. *In Tim.* vol. 2, 214.6–215.4 Diehl = Porph. *In Tim.* fr. 69 Sodano. But Proclus does not cite Porphyry when examining the mathematical technicalities of the construction, and we know nothing of any detailed analysis he may have offered.

¹⁵ For a general assessment of the light shed by the commentary on Neoplatonist thought see Gersh (1992). There is a useful conspectus of recent work on its philosophical aspects (focused especially on I.1 and I.3) in Chiaradonna (2012).

itself – to support any judgement at all. Internal evidence cannot give us a definite answer (there are, for instance, no references forward to any part of the commentary after II.7, which might at least have clarified Porphyry's intentions), but it makes me lean tentatively to the view that he abandoned the task or put it aside in favour of other projects. Perhaps he intended to come back to it one day, but in the event he never did so. By the point at which the text runs out he had already laboured through a long series of technically demanding chapters in which he had found little fuel for independent thought, and there were a dozen more in a similar vein to come before he could emerge into the philosophically alluring uplands of III.3 and its sequels. It would not be very surprising if he lost his appetite for the task and left it unfinished; even the almost indefatigable Porphyry might have found it too wearisome to contemplate. There is also another, perhaps more compelling reason why he might have thought it pointless to continue, but I must postpone it until we have considered his purposes in writing the commentary (Section 7 below). None of this comes anywhere near to proving my hypothesis, of course. Maybe he soldiered on to the end, and the later parts of the manuscript from which all ours are derived were mislaid by a careless librarian.

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¹⁵ For a general assessment of the light shed by the commentary on Neoplatonist thought see Gersh (1992). There is a useful conspectus of recent work on its philosophical aspects (focused especially on I.1 and I.3) in Chiaradonna (2012).

true views, not as their replacement or revision.¹⁶ Porphyry, of course, was not signed up to any Ptolemaic *hairesis* – no such ‘school’ existed – but he presents arguments against Ptolemy’s views only twice, once over a major issue (see Section 4(b) below) and once on the details of a definition (of no great importance in its context, though with significant implications for modern classicists; see pp. 42–3 below). Throughout the rest of the commentary he treats Ptolemy with much the same kind of respect as was given to the founder of a school by its adherents.

One of the features of the *Harmonics* that especially attracted Porphyry was the philosophical richness of its reflections on scientific method, and on the roles of sense-perception and reason in the proper conduct of investigations in the science that concerns him here.¹⁷ Only the first two of Ptolemy’s chapters are devoted almost exclusively to these topics (they amount to three pages, to which Porphyry gives twenty-four pages of discussion), but both writers return to them from time to time elsewhere (for instance towards the end of Porphyry’s I.7), and repeatedly draw attention to the ways in which Ptolemy is applying the principles he has established. In I.3–5 Porphyry finds further opportunities for elaborate philosophical excursions of other sorts, and though I.6–7 are designed mainly to explain the technical terminology that Ptolemy uses in these chapters and to elucidate his musicological arguments, they too repay reading with the eyes of a philosopher, and have a good deal to interest historians of mathematics. But from I.8 onwards the *Harmonics* offers less grist to a philosopher’s mill (though for non-philosophical reasons Porphyry has a good deal to say about that chapter too), and this is clearly one reason why Porphyry’s comments become so much more perfunctory from I.9 onwards. From a philosopher’s perspective, the first five chapters of the commentary are the most challenging and important. I cannot examine their arguments closely here, but after sketching some of their most prominent topics I shall add a little more detail about two particularly remarkable passages.

Ptolemy opens the *Harmonics* by defining his science, harmonics and its subject-matter; what harmonics studies, he says, are the differences

¹⁶ Sedley (1998): 68–9. In Sedley (1997): 114 with n. 11 he argues that the origins of this use of the commentary form go back to Crantor’s commentary on the *Timaeus* in the early third century BC; he finds no evidence for the contrary view of Dörrie and Baltes (1987–2002) vol. 1: 328, vol. III: 166. Commentaries on Aristotle first appeared around the end of the Hellenistic period: see especially Gottschalk (1990), Sedley (1997). For Porphyry as the first Platonist commentator on Aristotle see Karamanolis (2004).

¹⁷ These aspects of the *Harmonics* are discussed in Barker (2000). For Porphyry’s preliminary comments on Ptolemy’s philosophical credentials see 4.16–21.

between high and low pitches in sounds. Porphyry begins I.1, correspondingly, with a study of Ptolemy's definitions and of those that other theorists have provided for the science and its subject, commenting on their merits and defects, and discussing the ways in which different definitions lead to different investigative strategies. Later in the chapter, drawing implicitly on Aristotle, he analyses three types of definition, and examines the distinctions and relations between definitions and demonstrations. In several passages elsewhere in the commentary he again examines definitions that theorists have offered for concepts central to the science, dwelling on the conditions they should fulfil and on the traps into which an inadequate definition can lead. His insistence on accurate definitions should not be mistaken for mere pedantry. They carry substantial implications both about the nature and constitutive elements of the science's subject, and about the methods by which the investigation should be conducted.¹⁸ There is nothing trivial, then, about the scientist's task of defining key concepts precisely and appropriately, guided by a philosophically informed understanding of the logic of definitions and the epistemological and ontological commitments they may involve.

But both Ptolemy and Porphyry devote the bulk of I.1 and I.2 to a group of fundamental epistemological issues, which are often revisited more briefly in later chapters. At the heart of them are questions about the roles that should be assigned to sense-perception and to reason (especially mathematical reason) in the pursuit of scientific truth. They are introduced in the context of debates about the 'criterion of judgement', which – together with the closely related 'criterion of truth' – had been a regular topic of discussion since the Hellenistic period.¹⁹ Ptolemy uses his reflections on these issues not only as a foundation for his own methodology, but also as the main setting for his critiques of the competing positions of followers of the two main traditions in harmonic science, the Pythagoreans and the Aristoxenians, which occupy much of Book I. (He does not in fact mention them until I.2, whereas in the commentary they already play leading roles in I.1.) Porphyry expands Ptolemy's discussions of the contributions that can and cannot be made to science by perception and by reason respectively, of the extent to which each is reliable in its own sphere,

¹⁸ Cf. Gersh (1992): 149. 'Since Neoplatonist writers invariably hold that all terminology in the texts upon which they comment is technical in character and fixed in its range of meanings, even passing allusions evoke complex structures of thought extending considerably beyond the basic sphere of discussion.'

¹⁹ For discussions of the concept of a 'criterion' and its history see especially Striker (1974) and (1990), Brunschwig (1988), and Huby and Neal (1989), which includes also an edition and translation of Ptolemy's short treatise *On the Criterion*. Cf. also Dumont (1982).

of the connections between sense-perception and matter and between reason and form, and of the ways in which the powers of each faculty supply what is lacking in the other. Neither on its own is adequate to the task of establishing truths in the field of harmonic science. Hence they should not be treated as rivals, and although reason will play the dominant part in significant respects and sense-perception will pay it due homage, scientific enquiry must bring them into a cooperative partnership in which each performs its appropriate tasks. He also pursues issues about the causal role of reason, which Ptolemy mentions only in passing at this point in the text.²⁰ From there he proceeds by stages into one of the most fascinating philosophical passages in the commentary (II.1–15.29), of which I shall say more in Section 4(a); it has no direct counterpart in the *Harmonics*, but I shall argue below that Porphyry's inclusion of it here is nevertheless well judged. It is a sustained discussion of the sequence of steps through which an enquiring mind progresses from an initial perception to complete understanding, of the parts played in the progression by various mental faculties and of the nature of the processes involved. It culminates in a series of graphic images and analogies which bring us back eventually to the broader themes to do with sense-perception and reason which occupy the rest of the chapter.

I.2 is shorter, and much of it is taken up with quotations from two earlier writers. Most of Porphyry's own comments are concerned with the 'criteria' adopted by theorists in the two principal harmonic traditions, the Pythagoreans and the Aristoxenians; his expositions and criticisms add little to those of Ptolemy, and like Ptolemy he makes no attempt to identify variant positions in either school of thought. By contrast, one of the writers he quotes, Ptolemaïs of Cyrene (the other is a musical theorist named Didymus²¹), makes interesting distinctions between two Pythagorean viewpoints, that of 'Pythagoras and his successors' (25.10–14) and that of the Pythagoreans who quarrelled most vigorously with empirically oriented theorists (25.25–26.1). She also picks out differences between the views of Aristoxenus himself (25.18–25) and 'some of the *mousikoi* who follow Aristoxenus' (26.1–4), and identifies one other group who apparently stand outside both traditions (25.14–16, cf. Didymus at 26.6–15). Between them Ptolemaïs and Didymus provide a finer-grained

²⁰ In his allusion to 'cause' at *Harm.* 3.5; cf. also 5.19–24. He develops the theme more fully in III.3.

²¹ Porphyry asserts at 5.11–14 that much of Ptolemy's work was based on the writings of this Didymus. In the passages quoted here Didymus is evidently dependent in part on Ptolemaïs, but (so far as we can see from Porphyry's selective quotations) he omits some of her distinctions, while significantly expanding her account of Aristoxenus' views.

classification of these competing views about the criterion than any other ancient writers on harmonics, distinguishing at least five different positions that previous theorists had adopted. Ptolemaï's may have lived quite early in the Hellenistic period, while Didymus probably belongs to the first century AD, and their reports clearly need to be interpreted against the background of philosophical debates on the criterion that were current in their times.

Ptolemy's third chapter is designed primarily to establish the conclusion that differences of pitch are essentially quantitative, and hence that they can properly be represented and studied in mathematical terms. He asserts that the only way of discovering whether they are differences of quantity or of quality is to consider the nature of their causes. In pursuit of this objective he examines a long series of ways in which the causal antecedents of a sound may vary, classifies them as qualitative or quantitative, and identifies each of the attributes of sound which result from these differences in its causes.²² Porphyry's commentary on the chapter is the longest in the work and includes much the largest volume of quotations. He follows Ptolemy step by step through his arguments, elucidating them as he goes; but fully half of the chapter (43.23–67.14) is devoted to the task of demonstrating not only that Ptolemy's reasoning on the subject of pitch is flawed but that the conclusion he draws is wrong. Differences in pitch are differences of quality, not of quantity.²³ Only a couple of short passages elsewhere in the commentary can be construed as criticisms of Ptolemy, and the fact that Porphyry sets up this particular dispute with him and develops it at such length demands an explanation. But the passage is also of great philosophical interest in its own right, partly for the subtlety of its argumentation, and especially on account of three of its other features: its construction of a disagreement between Plato and Aristotle and its recruitment of the controversy to his theme; its rather half-hearted gesture at a strategy for reconciling the two great philosophers; and its detailed and intricate deployment of Aristotle's theory of categories.²⁴ This is the second passage to which I shall return (pp. 22–7).

²² Ptolemy's negotiation of the question whether an effect must always fall into the same category as its cause is slippery and not altogether satisfactory, as Porphyry will point out with some relish. I shall say a little more about this later.

²³ If Porphyry had thought that the qualitative character of difference in pitch altogether disqualified Ptolemy's mathematical approach, his commentary would have been virtually pointless. But he did not; as he notes at 88.1–7, it is still legitimate to treat the qualities as supervening upon quantitative distinctions which are the causes underlying them, and the business of mathematical harmonics is with the relations between these quantities.

²⁴ There has been much discussion in recent decades of Porphyry's interpretation and uses of the *Categories*, his attempts to integrate it with Plato's doctrines and the extent to which his views about it can be harmonised with those of Plotinus. See e.g. Evangelidou (1988); Ebbesen (1990):145–90;

There are few free-standing philosophical passages in I.4–5; material of interest to philosophers is closely integrated into discussions of issues specific to harmonic theory. I.4 contains several further passages on the definitions of important terms and on the various ways in which theorists had used them, including a particularly interesting discussion of proposed definitions of a note, *phthonggos* (86.1–87.19). The chapter also offers reflections on the respects in which pitch is both unlimited and limited in range and divisibility, and on the senses in which a note is both unified and divisible. But its most philosophically substantial passage (83.1–85.33) is a discussion of continuity and discontinuity, both in general and in the special context of sounds as they move from one pitch to another, where ‘continuous’ movement – usually conceived as involving an unbroken glissando between pitches – is characteristic of speech, and ‘discontinuous’ movement, leaving spaces (intervals) between distinct and stable pitches, is characteristic of melody. Like all such discussions after the fourth century BC, and there are many, it draws on Aristoxenus’ classic account in the *Elementa harmonica*. But it modifies and supplements it in interesting ways, notably in its treatment of the continuous form of movement, where it offers some curious examples, and apparently vacillates over the question whether sounds that move between pitches in this way remain steady on a definite pitch for no time at all, or for a length of time that has duration but is too small to be perceptible, or indeed for a length of time in which we can and do perceive its steady pitch.²⁵

Porphry’s main topic in I.5 is the concept of ratio (*logos*), which is of course fundamental to the mathematical form of harmonics. After briefly introducing the subject with quotations from the *Sectio canonis* and from Euclid’s *Elements*, he moves on into a five-page study of the relations between ratio and two other pivotal concepts, those designated by the terms *diastēma* (‘interval’) and *hyperochē* (literally ‘excess’). A *hyperochē* can be thought of, very roughly, as the amount by which one term exceeds another, or more roughly still as the difference between two terms; but those formulations are not adequate to capture Porphyry’s normal usage; and the matter is further complicated by the fact that both he and other writers use the word in several significantly different senses. (I spell out these complexities more fully in Section 8 below.) Nor are they always

Hadot (1990), (1999b); Sorabji (1990): 1–2; De Haas (2001); Fazzo (2004): 8; Chiaradonna (2004); Karamanolis (2004), (2006): 312–22.

²⁵ See further Section 5(d) below. There is a comparable uncertainty in another context at 30.19–31.21 – though perhaps it can be resolved – in a passage quoted from Heraclides.

consistent in their uses of the word *diastēma*, or in the relations that their usages imply between a *diastēma* and a *logos*.²⁶ Porphyry is well aware that writers' applications of these terms differ (though he does not always alert us to variations in his own), and armed with an array of quotations from a wide selection of sources he does his best to clarify the distinctions and to analyse and classify the various usages. His discussion is sometimes confusing and possibly confused, but it is nevertheless illuminating, and at the least it should stand as a warning that in the mathematical sciences as in others, the connotations of technical terms are not always the same and not always consistent with the definitions assigned to them, even when they are being used by eminent specialists.

In musical contexts *diastēmata* are musical intervals, some but not all of which are concordant. Notes bounding concordant intervals mark the outlines and the main internal divisions of harmonic structures. Detailed analysis of these structures in mathematical harmonics begins from the study of the concords, coupled with the identification of the ratios corresponding to them; it subsequently works out the sizes or ratios of the smaller, non-concordant intervals between their boundaries by dividing the ratios of the concords in mathematically appropriate ways. (Thus it does not proceed additively, by quantifying small intervals first and then using them as building-blocks in the construction of larger systems.) Ptolemy's chapter sets out on this enterprise by discussing the Pythagoreans' ways of addressing it. Hence after his study of ratio, interval and *hyperochē* Porphyry moves next to a discussion of concordance and the ways in which previous writers had represented and defined it; and from there he goes on to elucidate Ptolemy's account of the procedures used by the Pythagoreans for deriving and classifying the ratios of concords, and for placing them in an evaluative hierarchy.²⁷ He ends his discussion of I.5 by quoting the first sixteen propositions of the *Sectio canonis* insecurely attributed to Euclid, on the grounds that it will serve to clarify the whole contents of Ptolemy's chapter and to fill gaps which its account of Pythagorean doctrine had left.²⁸

²⁶ For discussion of this issue see Raffa (2013).

²⁷ In the commentary on I.6, in which Ptolemy criticises the Pythagoreans' approach to these issues, Porphyry presents a careful description (107.15–108.21), derived ultimately from Archytas, of a procedure by which earlier Pythagoreans constructed such a hierarchy. It is an important passage, partly because Porphyry records the procedure clearly and objectively, as Ptolemy does not, and especially for its evidence that the procedure was used by Pythagoreans of the early fourth or the fifth century BC, of whom we know all too little.

²⁸ Both Ptolemy and Porphyry regard the *Sect. can.* as a Pythagorean text. See further Section 5(a) below.

*Two passages of special philosophical interest**(a) II.I–I5.29*

This section of I.I has attracted a good deal of attention in recent years.²⁹ Its importance has been especially emphasised in studies of Porphyry by Riccardo Chiaradonna. He has highlighted and discussed its unusual combination of a Platonist commitment to the theory that knowledge is already present in the soul prior to any investigation, waiting to be uncovered,³⁰ with an intricate and fundamentally Aristotelian analysis of the stages on the route from an initial instance of sense-perception to the awakening of perfect understanding;³¹ its articulation of a theory in which transcendent and immanent universals are ‘two different levels in the same hierarchy of being’;³² the ways in which it addresses and illuminates passages in Porphyry’s other writings; and its connections with the work of Alexander of Aphrodisias.³³ These are fascinating themes, but I would like to take the discussion in another direction by bringing it back to its context in the commentary, which wider-ranging studies have tended to leave in the shadows.

The statement that attracts these five pages of discussion is at *Harm.* 3.3–5: ‘The criteria of attunement are hearing and reason (*logos*), but not in the same way; hearing judges on the basis of the matter and the attribute, reason on the basis of the form and the cause.’ After a few preliminaries, Porphyry focuses first on what the ‘ancient writers’ say about the relations

²⁹ The most detailed analysis of it is Tarrant (1993): 108–47. He examines its contents with care and insight, but scholars have not generally accepted his contention that the bulk of it is quoted or paraphrased from Thrasyllus, or closely based on his work; see e.g. Lautner (2007): 84 n. 23. We can at least be sure that the quotation from Thrasyllus beginning at 12.21 does not continue far, if at all, beyond the point at which Düring took it to end (12.28). Porphyry uses the formula introducing the quotation (‘as So-and-so says’) only for short quotations; long ones are always introduced by complete sentences. He also tells us explicitly where long quotations end, either with a statement such as ‘That is what So-and-so says’ (e.g. 26.4–5, 28.27, 36.3, 51.1, 77.19–20), or by some other explicit indication that the quotation has finished (e.g. 46.14, 47.24, 57.24, 67.11, 93.18–19, 103.26).

³⁰ This has affinities with Plato’s theory of *anamnēsis*, ‘recollection’, but Porphyry does not refer to it in those terms. Mueller (1990): 479 asserts that his account of the activation of *nous* by *epistēmē* ‘remains “Platonic” because the activation is a stimulation to recall rather than an implanting of something new’; but there is no allusion to ‘recalling’ in the text, and nothing that directly implies it.

³¹ Cf. also Karamanolis (2006): 311–12.

³² For partial anticipations of Porphyry’s position in Seneca and Alcinoüs see Chiaradonna (2007c): 36. On p. 46 he draws some particularly striking and controversial conclusions. ‘Immanent forms are Aristotelian forms impressed by the *logos* on matter. Their actual subsistence in matter is a “corporealization”: they do not exist as incorporeal in the physical world . . . Abstraction is something like a “dematerialization” of the immanent forms . . . The abstraction of the form in the soul is not an image resulting from the empirical observation of similarities, but it is *the form itself* de-materialized and “stored” in the soul’ (author’s italics). For a contrary interpretation see Karamanolis (2004): 107.

³³ See especially Chiaradonna (2007a), (2007b), (2007c); for other discussions see his bibliographies.

between reason, sense-perception, form and matter. They say that not everything judged by reason is judged also by perception, but everything judged by perception is judged also by reason. What both of them judge is form, since the form of a perceptible object is apprehended not only by reason but by perception too; reason grasps only the immaterial form by itself, while perception grasps it in its association with matter – it is ‘of the form as enmattered (*enhyllon*)’ (11.13). There are, correspondingly, three modes of definition, all of which are concerned in one way or another with form (here he draws directly on Aristotle): some definitions specify only the form, some bring together the form and the matter, and some specify only the matter, but the matter conceived as potentially receiving the form (the last of these, which Porphyry attributes to the Stoics, now drops out of sight).

Ptolemy’s text suggests no connection between perception and form, and Porphyry does not say that he subscribes to these ‘ancient’ doctrines; but he plainly implies that they provide a clearer understanding of Ptolemy’s view. The suggestion is well founded. It is essential to Ptolemy’s methodology that the forms which reason grasps accurately and represents mathematically should be the same items as those which the hearing grasps ‘in rough outline’, that the impressions of sense-perception can be corrected under the guidance of reason, and conversely that in appropriate cases perception can provide evidence that reason has gone astray.³⁴ Then it follows immediately that if what reason finds in the realm of perceptible things is form, form must also be accessible to perception, even though it is presented to each of the two faculties in a different way. Ptolemy does not say this; the manner in which he contrasts perception and reason seems to imply, in fact, that perception makes no contact with form. But without the contribution made by the doctrines that Porphyry records, it is hard to see how Ptolemy’s methodology can make sense.

When Ptolemy says that reason (*logos*) judges ‘on the basis of’ (*para*) the cause as well as the form, he means that the cause is one of the things that human reason can identify. But here again Porphyry takes a different path. He tells us that according to the ancients, *logos* is the judge of perceptible things not only ‘as’ (*hōs*) the form but also ‘as’ – that is, as being – the cause (12.5–6); and he continues with this theme to 13.14. He explores the concept of the ‘*logos* in nature’, which imposes form on matter and organises the material things in the universe, and which is in some way ‘imitated’ in the reasoning of the soul, adding a quotation from Thrasyllus (12.21–8) which

³⁴ See Barker (2000): 14–32.

encapsulates these ideas. The quotation ends by saying that our intelligence (*nous*) 'makes an impression of what a thing is and demarcates and confirms the essence of each thing, which is expressed by the *logos* that defines and the *logos* that demonstrates'; and this propels Porphyry into a discussion of the difference between a definition and a demonstration. It is an extremely difficult passage which I shall not try to anatomise. The salient point here is that what 'the *logos* that demonstrates' introduces between a major premise and a conclusion is a statement of the causal connection between them; and given that our reasoning – the activity of the *logos* within us – imitates the activity of the *logos* in nature, this reinforces the thesis that this *logos* has the character of a cause.

In this case too Porphyry has taken us well beyond the immediate implications of the lemma on which he is commenting, but again without seriously misrepresenting Ptolemy's intentions. Ptolemy does indeed hold that our reason can grasp the form and order of things in the universe *because* it is reason that has given them form and order. In I.2 (5.20–4) he tells us that 'the works of nature are crafted with reason and with an orderly cause, and . . . nothing is produced by nature at random or just anyhow, especially in its most beautiful constructions, the kinds that belong to the more rational of the senses, sight and hearing'; and in III.3 he discusses at some length the relations between reason's causal and heuristic functions. It is perhaps unlikely that he subscribed to every detail in this part of Porphyry's discussion, but for Platonist readers it would serve well as an intelligible expansion of his views.

Porphyry now introduces the passage that seems most distant from Ptolemy's themes, either in I.1 or elsewhere in the *Harmonics*. Ptolemy says nothing about the process through which we pass between the perception of a phenomenon and a rational understanding of its form, except that the principles we draw on in reasoning towards this understanding must remain faithful to the doctrine about the works of nature to which I have just referred. For Porphyry, on the other hand, the business of intellectually detaching a thing's form from the matter in which reason has embedded it, and then receiving it into the soul, is very complex, and he proposes to analyse it in order, he says, to make clear how our judgements are brought to completion (13.19–21). The account that follows at 13.24–14.6 is unmistakably Aristotelian in conception, analogous but not identical to the ones presented in *Posterior Analytics* II.19 and more allusively in *Physics* I.1. It identifies in sequence the functions performed at each stage in the progression and in some cases names the faculties responsible for them. There is nothing unusual about this in itself; the Stoics had devised their own

adaptations of the Aristotelian scheme, and others before Porphyry, including Platonists, had also co-opted Aristotle's strategy for similar purposes.³⁵ But Porphyry's version has complexities not found elsewhere.³⁶

Five stages are involved: (i) an 'apprehension' (*antilepsis*) arising from sense-perception (*aisthēsis*), which introduces the form into the soul; (ii) 'opinion-based supposition' (*doxastikē hypolēpsis*), which identifies the form by name and in this sense says what it is; (iii) imagination (*phantasia*), a faculty with at least three functions: it represents the form in a graphic, quasi-perceptible way, it checks the accuracy of the likeness it has created, and it stores the form away in the soul in the guise of a 'concept' (*ennoia*); (iv) the condition of knowledge (*epistēmē*), which comes into being when the concept is 'firmly established'; and finally (v) *nous*, conventionally translated as 'intelligence', but envisaged as a direct, non-discursive awareness of true reality. It arises from *epistēmē* 'like light ignited from a leaping fire', a simile that suggests a sudden enlightenment. Porphyry offers no further explanation.³⁷

Several of the details in this account are hard to interpret, and are complicated by the fact that the summary with which Porphyry follows it (14.6–14) does not tally in all respects with the original version. The difficulties are especially acute in the case of *phantasia*, whose roles are remarkably diverse; they seem to overlap with those assigned to it by Aristotle (*De anima* 427b–429a) and by the author of the *Didascalicus* (4.13), but to include others as well.³⁸ It does not appear in Aristotle's description of the ascent to knowledge in the *Posterior Analytics*. Porphyry's representation of it may owe something to the intricate debates of Hellenistic Stoics,³⁹ but

³⁵ The Platonist version closest to Porphyry's is probably that of Alcinous (or Albinus – the writer's identity is disputed) in *Didascalicus* 4; see particularly 4.8–14. The passage is translated and discussed in Sharples (1989): 235–40. Cf. e.g. Alex. Aphr. *De an.* p. 66 Bruns, Sext. Emp. *Pyr. hyp.* II.70–8, Ptol. *De judic.* 2.4 Huby and Neal = vol. III.2, p. 5 Lammert, Plut. *De an. procr.* 1024E–1025A.

³⁶ Some of them seem to arise from a fusion of conceptions drawn from Plato with those of Aristotle. For an example see Sheppard (2007): 74 on *doxa* and *hypolēpsis*.

³⁷ On the passage setting out these five stages see especially Chase (2010), who however treats the emergence of the concept (*ennoia*) as a distinct stage, and therefore identifies six. As well as analysing the doctrines of the passage, he sheds a good deal of light on the sources from which it is derived, showing convincingly, for instance (389–90), that stages (ii)–(iii) originate in Plato *Philebus* 39a–c, arguing at length (392–5) that much of Porphyry's account – and especially the stage involving *ennoia* – is closely related to Theophrastus fr. 301A Fortenbaugh, and identifying (396) Porphyry's statement about *nous* as a fusion of Aristotle's account of it with Plato *Seventh Letter* 341c–d. For an earlier analysis (on which Chase comments) of 13.24–14.14 and the problems it poses see Tarrant (1993): 120–30, which also includes suggestions about its relation to other sources.

³⁸ For a study of *phantasia* in Porphyry see Sheppard (2007), and on the whole topic of *phantasia* in Greek philosophy see Waters (1988).

³⁹ See e.g. Sext. Emp. *Adv. math.* VII.49, Diocl. Magn. *apud* Diog. Laert. VII.49, Alex. Aphr. *In Ar. de anima* 72.5 Bruns.

from a conceptual point of view its complexities are evidently due, at least partly, to its position as a kind of pivot between the stages linked closely to sense-perception and those that deal with concepts and pure forms alone.⁴⁰ In order to mediate between them it must somehow operate in both these spheres.⁴¹

Ptolemy's enterprise, for all its mathematical abstractions, aims at the analysis of empirical phenomena, and it is they that provide its starting-points. It is unsurprising, then, that a philosopher like Porphyry, deeply influenced by Aristotle's writings, should feel the need to explain how the workings of the human psyche can bridge the gulf between sense-perception and rational understanding of what is perceived, and that his account should follow an Aristotelian pattern. Its intended relevance to the context set by the opening lemma – that is, Ptolemy's association of reason with form and cause – is brought out clearly in the sequel (14.14–28). 'What happens is like this', says Porphyry (14.14–15), meaning 'what happens by means of the process I have just described is as follows'. He depicts it through the image of an incised design on a ring which impresses its form on a piece of wax (this corresponds to the causative action of reason, which gives the form corporeality), after which the raised design in the wax is impressed on another piece of matter to create a replica of the original (this is the reception of the form by the soul, once again detached from its bodily setting).⁴² After a few more lines elaborating these thoughts (14.21–8), he prefaces a brief summary of the principal doctrines of *Harmonics* I.1 with the confident assertion that what he has been saying explains them (14.29–15.9).

But there is one last twist in the passage. Porphyry inserts into the summary I have just mentioned the statement that whereas sense-perception

⁴⁰ In this role, *phantasia* played a significant part in Byzantine controversies in the period of iconoclasm. Those who championed sacred images as accessories to worship were often accused of idolatry. Their own contention, however, was 'that icons were a sort of window to holiness, which is why they felt the need to preserve *phantasia* as a space in-between corporeality and mental abstraction' (Pizzone 2012: 45).

⁴¹ Mueller (1990): 479 says that *phantasia* 'does not copy sense impressions exactly, but introduces accuracy into the images and presents them to the soul as *ennoiai* (concepts)'. This is a fair précis of Porphyry's account, but it incorporates the problem rather than resolving it. What are we to make of the transition between (accurate) images, which Porphyry describes in terms of painting and sculpture, and *ennoiai*, which he identifies with forms?

⁴² As an anonymous reader kindly reminds me, the ultimate source for the use of the image in this context is clearly Aristot. *De anima* 424a17–24. In the image the matter to which the form is transferred from the wax is of course corporeal; by contrast, its counterpart in the soul still counts as 'matter' for the reception of form, but it is incorporeal matter. See 13.15–19. Porphyry's remarks at 13.29–32 and uses made of similar imagery by the Stoics suggest that the incorporeal replica is constructed at the stage of *phantasia*; cf. e.g. Diog. Laert. VII.46, Diocl. Magn. *apud ibid.* VII.50, Philo *Quod deus sit immut.* vol. 2 p. 64.1–6 Wendl, Alex. Aphr. *In Ar. de an.* 68.11, 72.5 Bruns.

judges by being affected by something else, reason 'turns out to have grasped *in advance* the whole thing that is judged, as if it *contained in itself* the form of the object of enquiry, and does so more accurately than when the investigation focuses on perceptible objects' (14.33–15.4). This plainly takes us back into Platonist territory, and Porphyry brings his picture vividly to life in the long analogy with which the passage ends (15.10–29). Reason is like a king who always stays in his palace, but who knows everything accurately in advance of any external information. The senses are his spies and messengers, who go out into the world and bring back reports of what they take themselves to have observed. Their reports are rough and sketchy, but the king, 'since he knows everything in advance, does not merely learn what has been reported, but learns also whether the messenger has presented it inaccurately, and learns, in short, the whole constitution of what has been indicated to him'. When Porphyry unpicks the analogy he adds a further point: reason 'takes from perception as much as perception can report, and by itself discovers (*heuriskei*) what is accurate, *making perception, too, more accurate* through the latter's association with it' (15.26–8). He goes on to tell us that Ptolemy 'presents these points when he writes as follows, immediately after the passage we have discussed', and this introduces the next lemma.

The statement at 15.26–8 corresponds perfectly to what Ptolemy says. Reason is a 'discoverer', and when it has made its discoveries sense-perception will readily accept correction and fall in line with its conclusions (see especially *Harm.* 3.14–4.7). On the other hand the idea that human reason contains knowledge in advance of enquiry is not in Ptolemy; it seems to be Porphyry's Platonist interpretation of his position, and at first sight it seems to fit uncomfortably with the depiction of reason as *discovering* truths. But there need be no tension between them. When Porphyry comments later on Ptolemy's representation of reason as stable and autonomous by contrast with the instability of sense-perception, he attributes to ancient authors, with apparent approval, the thesis that it is 'unimpeded in its activities', and he interprets Ptolemy's description of it as 'autonomous' as meaning that 'it is self-sufficient for making the discovery which is its proper goal; for it is self-moved'.⁴³ There are obvious echoes here of Aristotle's account in *Metaphysics* XII of the unmoved mover, engaged eternally in the activity of self-contemplation, with the difference that the divine mind is not moved or changed at all, even by itself; it and its activity are always exactly the same. Human reason, by contrast,

⁴³ 18.1–2, 10–12, cf. 11.13–16. The passage of Ptolemy is *Harm.* 3.14–20.

is not perpetually aware of all truths. It must search them out, but it is 'self-moved' and 'self-sufficient for making the discovery' without external assistance; and a Platonist would argue that this can only be the case if the truths are already built into it, inherent in its essence as reason.

Summarily, then, the passage we have been discussing holds together as a coherent sequence, and despite the distance it travels away from Ptolemy's text, none of it is irrelevant to the declared purposes of the commentary. Tarrant may be right to say that its treatment of the thesis that *logos* is a criterion in harmonics 'has certainly not been originally devised for the purpose of explaining Ptolemy's claims: Porphyry is adapting it for that purpose'.⁴⁴ If so, he could have adapted it either from some previous work of his own, or from a source or sources among the Middle Platonists; it is even possible, as Tarrant argues, that the source is Thrasyllus. I am not convinced that the case for regarding it as an adaptation is conclusive; but whether it is or not, the passage as a whole is very well suited for the task to which Porphyry has put it.

(b) 43.23–67.14

Porphyry's central purposes in this intricate passage are first to undermine the arguments by which Ptolemy tried to show that the differences between pitches of sounds are differences of quantity, and secondly to demonstrate that he was in fact wrong, and that they are differences of quality. Along the way, at 45.22–49.4, he brings the views of Plato and Aristotle into the picture, quoting *Timaeus* 67b–c and *De anima* 420a–b. In the main part of this discussion he interprets Plato as adopting the quantitative view; Aristotle, by contrast, on Porphyry's analysis, held that while the causes of high and low pitch are quantities and vary quantitatively, their effects, the attributes themselves, are qualities. Thus he takes Plato's position to be identical in the relevant respect with Ptolemy's, and Aristotle's with his own. Yet he implies at the beginning that their positions are identical, and at the end he argues that when suitably understood their apparently conflicting opinions can be reconciled. The whole passage revolves around the Aristotelian theory of categories, and can usefully be compared with Porphyry's discussions of it in other writings.⁴⁵

His critique of Ptolemy's reasoning is long and detailed, but in essence it takes the form of a dilemma. Its general shape can be sketched as follows

⁴⁴ Tarrant (1993): 110.

⁴⁵ The fullest discussion of this passage is in Karamanolis (2006): 257–66. His interpretation of it is radically different from mine, and I shall add a brief résumé of our disagreements at the end of this section.

(though I omit some steps that are essential for Porphyry's special purposes). Suppose, first, that Ptolemy maintains that an effect must always be in the same category as its cause, a principle that he strongly suggests at the beginning of I.3 (*Harm.* 6.14–18) and which holds good for many of the causes and effects he goes on to discuss. But in that case he contradicts himself at *Harm.* 7.17–23, where he says that although denseness, diffuseness, thickness and thinness are qualities, they are caused by quantitative features of the items which they characterise. This clearly contravenes the principle. In the next sentence he adds that the qualities of thinness and thickness in sound-producing objects cause high and low pitches respectively. But he has said that though thinness and thickness have quantitative causes, they themselves are qualities; and in that case there are no grounds at all for the inference that their effects, height and depth of pitch, are attributes that differ quantitatively. If we apply the principle in their case regardless of its contradiction in the other, we might equally argue that since the causes of differences in pitch are qualities, the differences themselves must be qualitative too. The second horn of the dilemma can be very briefly expressed. Suppose that Ptolemy does indeed intend to allow that a cause and its effect can be in different categories. On that basis, however, we can grant him the thesis that differences in pitch have quantitative causes, but he cannot conclude from this that they are quantitative themselves. Then whichever choice he makes, his argument fails.

I shall not review Porphyry's arguments for the view that pitch-differences in fact belong to the category of quality, interesting though they are (see 58.5–61.15, together with the quotations from Theophrastus and Panaetius that follow). They cannot be neatly summarised, since they address the issue from at least five different and independent perspectives, and the excerpt from Theophrastus poses a good many thorny problems of its own. I have tried to untangle some of their trickier details in my notes to the passage. Let us pass on at once to Porphyry's discussion of Plato and Aristotle.

He introduces it as follows. The ancient writers

asserted that swiftness is the cause of high pitch and slowness of low. And since swiftness and slowness consist in quantity, one might grant that quantity is the cause of high and low pitch. Yet from this it does not follow that high and low pitch belong to the class of quantity; whereas if he [Ptolemy] had not represented swiftness as the cause of high pitch, but had said that the high itself is swift and the low itself is slow, as Plato and Aristotle thought, the high and the low would indeed belong to the class of quantity, since the swift and the slow are quantities. (45.22–30)

This plainly implies that Aristotle and Plato agree that height and depth of pitch belong to the category of quantity, but difficulties arise when Porphyry examines their views more closely, on the basis of what they actually say. After quoting *Timaeus* 67b–c, he sets about correcting an important misunderstanding to which other Platonists had succumbed (46.3–47.8). They had imagined that Plato was not attributing swiftness and slowness to high and low pitches themselves but to the movements that cause them, whereas Plato's real meaning is the opposite. Plato says nothing about their causes, and he assigns swiftness and slowness to the attributes themselves. Porphyry concedes that it could be argued that the swiftness and slowness of movement which – in Plato's view – are identical with high and low pitch must in fact be caused by movements of corresponding speed, but insists that this is not a view that can be extracted from the text itself (46.24–30). He concludes that since swiftness and slowness are quantities, so too, according to Plato, are high and low pitch (47.8–12). Plato, then, does indeed adopt the view that he and Aristotle were said to share.

But what about Aristotle? Porphyry quotes *De anima* 420a–b and delivers the first part of his analysis of it at 47.13–48.12. He concludes (for good reasons) that the thesis of the passage is that although swiftness is the cause of high pitch and slowness of low, high pitch itself is not swiftness and low pitch is not slowness; and he continues:

Aristotle is contradicting Plato when he says 'It is not the case that the high is swift', and nor is the low kind of voice slow – for it is against him that these remarks are directed – but high pitch arises *because* of the swiftness of the movement involved in the impact, and low pitch *because* of the slowness of the impact, so that a high voice is produced when the air's movement is very swift, and a low one when it is slow. (48.12–17)

Nothing could be clearer. Aristotle is contradicting (*antilegōn*) Plato on precisely the point about which they were previously said to agree. Porphyry continues to elaborate Aristotle's position for another ten lines, leaving no possible doubt that he construes it as differing radically from Plato's. Aristotle assigns pitch a quantitative cause but denies that pitch itself is a quantitative attribute, whereas Plato asserts that the attribute of pitch is quantitative, while saying nothing relevant about its cause.

At this point, however, Porphyry springs another surprise.

There is a difference between thinking of an attribute as the cause and the agent and thinking of it as that which is caused and acted upon. Aristotle says that the attribute [i.e. swiftness] is the cause, and because of this the swiftness of the impact of the air, which was said to be the cause of

the sound, produces its high pitch [lit. 'sharpness'].⁴⁶ The sharpness in tangible things, on the other hand, in a piece of iron, for instance, which was said to be the cause, makes the swiftness; and the same goes for heaviness and bluntness. Plato, however, holds that the attribute is that which is caused: 'when the voice is swift it is high ["sharp"]', and when it is slow it is low ["heavy"]. But if, as Plato says, as the agent acts, so that which is affected is affected, and conversely, the attributes arising in what is caused would pre-exist actively in the cause; and in this way the two philosophers would speak with one voice. (48.26–49.4)

The first sentence of this passage encapsulates the distinction on which the whole of Porphyry's argument depends. We are dealing here with two completely different theses, one concerned with the nature of a certain attribute, the other with that of its cause. The next three sentences summarise the results he has extracted from Aristotle's and Plato's statements: Aristotle's thesis is of the latter type, attributing swiftness and slowness to the causes of high and low pitch, while Plato writes in the former vein, assigning them to the pitches themselves. So far this is fully in line with the arguments that Porphyry has developed over the previous three pages. But the last sentence is very puzzling. It purports to offer a way of reconciling the two philosophers' positions, which would in effect confirm the impression given at 45.27–9, that they both accept that 'the high itself is swift and the low itself is slow'.

In the light of Porphyry's efforts to integrate Aristotelian and Platonic thought elsewhere in his writings, he might have found this a satisfying conclusion. But here it is anomalous and wholly unconvincing. Suppose, first, that we accept the principle attributed to Plato: 'as the agent acts, so that which is affected is affected, and conversely'.⁴⁷ In that case, since Aristotle has represented the cause (or agent) as acting in a way that is differentiated quantitatively, he will have to agree that the effects of these differentiations differ quantitatively too. Yet Porphyry has just argued at length that Aristotle emphatically denies this conclusion, and in a later passage he repeats the point with evident approval (58.5–16). Secondly, Porphyry is in no position to accept Plato's principle, since he not only attributes to Ptolemy the thesis that qualities can have quantitative causes but explicitly subscribes

⁴⁶ The regular Greek term for 'high-pitched' is *oxys*, literally 'sharp'; for 'low-pitched' it is *barys*, 'heavy'. The words' literal senses are relevant here; Aristotle says that they are transferred to sounds from their original application to tangible things, and his discussion draws attention to both the similarities and the differences between the ways they apply in these two domains.

⁴⁷ For the passage of Plato to which Porphyry is referring, and for further comments, see nn. 170–1 to the translation.

to it and argues from it himself.⁴⁸ If he interprets the principle that 'as the agent acts, so that which is affected is affected' as meaning that cause and effect must belong to the same category – as clearly he must in the present context – he cannot adopt it without undermining the central thrust of his argument against Ptolemy's contention that pitches vary quantitatively. Hence this attempt at a reconciliation between Plato and Aristotle is a miserable failure, and it is hard to believe that Porphyry had any faith in it; his remarks at 58.5–16 show that even if for a moment he did, he subsequently abandoned it. We may note that he expresses it only tentatively: 'if, as Plato says, as the agent acts, so that which is affected is affected . . . the attributes arising in what is caused *would* pre-exist actively in the cause, and in this way the two philosophers *would* speak with one voice'.⁴⁹

I mentioned earlier (n. 45 above) that Karamanolis (2006) interprets the passage very differently. Summarily, he argues that Porphyry's main objective is to show that despite their apparent disagreements, Plato's view and Aristotle's are in fact essentially the same, and that any remaining disparities are trivial. 'This suggests', he continues 'that Porphyry in general may have admitted the existence of differences between the two philosophers and still have held that these differences do not undermine their essential agreement' (258). To put it another way, he takes Porphyry's 'harmonising' statements at the beginning and end of the passage as expressing Porphyry's real view, and the intervening arguments as designed to explain away the apparent difficulties.

He arrives at this view, however, by assuming that the question on which Porphyry is focusing is about the way in which pitch and 'qualities in general' are produced, in other words that it is a question about the nature of their causes (258–9). But it is not. Karamanolis is mistaken in saying that at 47.10–11 Porphyry represents Plato as denying the Aristotelian view that there is a causal relation between speed and pitch (264); all that Porphyry says or implies is that Plato did not explicitly assert it. There is in fact no suggestion anywhere in the passage that Plato and Aristotle differ over this matter. The question at issue throughout is whether the attribute of pitch itself is quantitative or qualitative.⁵⁰ Karamanolis also

⁴⁸ See 44.28–45.3, 52.19–53.2, 58.5–16. Elsewhere he notes correctly that Aristotle also accepts the related thesis that an attribute may belong to more than one category: see Aristot. *Cat.* 11a and e.g. Porph. *In Cat.* 139.22–141.4 Busse.

⁴⁹ The phrases 'would pre-exist' and 'would speak . . .' represent constructions using the optative with *an*.

⁵⁰ Of the three passages which Karamanolis cites in support of his interpretation, 38.5–7 is irrelevant, and 45.17–20 and 49.5–8 are explicitly concerned with the categories to which height and depth of pitch belong, not with their causes.

contends that the thesis that 'high and low pitch are essentially rapid and slow movements respectively (45.27–30) . . . is Plato's view *and the one that Porphyry seeks to establish*' (259, my italics). In the light of the fact that the enormous array of arguments and testimonies running from 43.23 to 67.14 is almost entirely dedicated to demolishing this position, this strikes me as an extraordinary remark; and when he goes on to say that the view he has mentioned 'understands [high and low pitch] as quantities or, at least, qualities resulting from quantities', he is clearly implying that in the present context the distinction between quantities on the one hand and qualities resulting from quantities on the other is of no importance. But in truth it is absolutely central to the debate. The principal arguments in Porphyry's discussion of Plato and Aristotle are designed to highlight the difference between their positions, not to explain them away.

There are two substantial points on which Karamanolis and I agree. First, while believing that Porphyry's attempt to reconcile Plato's and Aristotle's views is seriously intended, he too thinks it a failure, though for different reasons from mine (264–5). Secondly, I have no doubt that the overall thesis of his book is correct, that is, that one of the main aims of Porphyry's philosophical endeavours was to integrate Aristotle's work into the study of Plato, though I find less evidence for it in the *Harmonics* commentary than he does. He is also right to represent Porphyry as thinking that minor differences between the philosophers' views need not prevent us from holding that they agree on 'essential' matters. But this leaves open the question what is essential and what is not; and that will depend on whether we are considering a doctrine's status in the context of the debate in which it appears, or in the context of Porphyry's broader philosophical concerns. In the present case the immediate issue is whether pitch is a quality or a quantity, and no doubt this question is fairly unimportant in the larger arena of Porphyrian thought. From that perspective the 'essential' agreement between the two need not be disturbed. In the immediate context, by contrast, nothing is more essential than this issue; the question is fundamental to Porphyry's agenda, and he finds that their answers to it are radically at odds. Plato's view about pitch is identical with Ptolemy's, which Porphyry elaborately refutes; Aristotle's, as Porphyry understands it, is the one he accepts and argues for, quoting Theophrastus and Panaetius at some length in his support. But he has explored the contrast between Plato's and Aristotle's opinions only for the sake of its bearing on his attempt to prove Ptolemy wrong, and we may perhaps conclude that he has allowed his enthusiasm for that project to override his more general conviction that Aristotle and Plato are – 'essentially' – singing from the same song-sheet.

5 The musicological content of the commentary

It can hardly be denied that much of the commentary's value to musicologists lies in its quotations from other writers, in its philosophical explorations of issues relevant to musical theory, and in such help as it gives in interpreting difficult passages in Ptolemy, but in this section I shall say little about any of these features. In particular, I shall not discuss the content of his best-known quotations (for instance those from Archytas, Plato, Aristotle, Theophrastus, the *De audibilibus* and the *Sectio canonis*). They have often been studied in the past, and I would merely like to encourage readers to take notice of the ways in which Porphyry uses them as well as the substance of what they say. Nor shall I attempt even a partial chapter-by-chapter summary of musicological topics, as I did for their philosophical counterparts in the previous section.

If we leave his philosophical reflections aside, Porphyry offers few thoughts of his own about musical matters. But among them are some that deserve close attention, as also do various passages in which he examines familiar concepts and ideas from unusual perspectives. The first subsection below comments on his representation of the two schools of thought in harmonics that dominate the discussions of Book I. The others pick out a selection of passages in which Porphyry provides unfamiliar musicological information or analysis, or faces us with unfamiliar problems.

(a) *Pythagoreans, Aristoxenians and others*

Porphyry tells us at the outset that the most important schools of thought (*haireseis*) in harmonics are those of the Pythagoreans and the Aristoxenians. There have been others in the past, he says, but 'because of their superficiality' they have almost entirely disappeared (3.1–12). Nothing in other texts of this period casts serious doubt on these remarks, but we need to be wary about how we interpret them. Who were the Aristoxenians to whom Porphyry refers, and did all of them follow Aristoxenus' doctrines to the letter? And how much is implicit in the word 'Pythagorean'? Varieties of Pythagorean philosophy and mysticism had become culturally and intellectually influential since their revival in the first century BC, not least in Platonist circles; Pythagorean ideas are very prominent, for instance, in the work of Porphyry's student Iamblichus. But it seems clear that in Ptolemy's *Harmonics* and in Porphyry's commentary alike, the term 'Pythagorean' is applied only on the basis of a theorist's approach to harmonic science, and implies nothing about his or her other intellectual commitments. Both

of them, for example, plainly regard the *Sectio canonis* (which Porphyry attributes to Euclid) as a Pythagorean text, though it betrays no philosophical allegiances of any substantial sort. It would be incautious, on the other hand, to go too far in the opposite direction, and assume that every writer who used the mathematical form of analysis characteristic of these Pythagoreans would automatically fall under the same description. Such analysis is fundamental to Ptolemy's work, but for Porphyry he is not one of the Pythagoreans, though 'in most respects he follows them' (9.1). Like the Pythagoreans, the theorist Didymus worked with the monochord and presented his divisions of the tetrachord as sequences of ratios, but neither Ptolemy nor Porphyry calls him a Pythagorean,⁵¹ nor do they attach the label to Eratosthenes, who also expressed his divisions in terms of ratios.⁵² And though both Plato and Aristotle made liberal use of propositions in mathematical harmonics, Porphyry certainly regarded neither of them as a Pythagorean (Ptolemy does not mention them).⁵³

The cases of Plato and Aristotle are unproblematic. Porphyry certainly knew that Aristotle had rejected the Pythagoreans' musical metaphysics and that Plato had criticised their treatment of harmonic theory; and in any case we would not expect him to represent them in terms that imply their intellectual subordination to any previous thinker or school of thought (except in so far as he regards Aristotle's work as partially dependent on Plato's). To place Ptolemy among the Pythagoreans would be equally absurd, given his trenchant criticisms of their views and Porphyry's determination to portray him as judiciously combining the best insights of both harmonic traditions.

It is less clear why these authors withhold the title 'Pythagorean' from Didymus and Eratosthenes. Two kinds of consideration may have a bearing on the matter. One is chronological. Ptolemy gives the title to only one named individual, Archytas,⁵⁴ and the only musical theorists named and described as Pythagoreans by other writers of the period are also figures from the fifth century BC and the early fourth, most notably Hippiasus and Philolaus. I have commented that Ptolemy and Porphyry implicitly treat the *Sectio canonis* as a Pythagorean document and that Porphyry ascribes it to Euclid. But he mentions Euclid several times and never calls

⁵¹ They call him 'Didymus *ho mousikos*', 'Didymus the specialist in music'. For his treatment of the monochord and his tetrachordal divisions see Ptol. *Harm.* II.13–14.

⁵² Ptol. *Harm.* II.14.

⁵³ A theorist with strong philosophical commitments to Pythagoreanism, Nicomachus, represents Plato as following directly in the path of the Pythagorean Timaeus of Locri (*Harm.* II, 260.16–17 Jan); but even he does not describe Plato as a Pythagorean.

⁵⁴ Porphyry seems reluctant to call even Archytas a Pythagorean; see n. 61 below.

him a Pythagorean, and his treatment of the *Sectio* probably reflects the impression that it is a compendium of Pythagorean propositions, not that its author was a Pythagorean theorist himself. Perhaps, then, the designation is reserved exclusively for the theorists of the early period.

But that cannot be the whole answer. Ptolemy plainly represents himself as confronting Pythagorean views that were current in his own time, and Porphyry explicitly contrasts the Pythagorean and Aristoxenian *haireseis* with those that had failed to survive. In that case, given the restricted range of named theorists to whom the term 'Pythagorean' is attached, we may guess with some probability that the unspecified contemporary Pythagoreans are those who continue to subscribe to positions that the early theorists had adopted. If so, they must have been identified by the methodological principles they brought to their investigations. Ptolemy comments on various errors committed by Pythagorean theorists, but his most general criticism is that they rely too exclusively on reason and improperly disregard the evidence of hearing. Ptolemaïos of Cyrene depicts them in the same way in passages quoted by Porphyry in I.2. Ptolemy, by contrast, is committed to the thesis that the conclusions to which reason leads us must be submitted to the verdict of sense-perception, and that if it conflicts with those conclusions we must admit that something has gone wrong in our reasoning. Propositions in harmonics cannot be regarded as scientifically established unless the two criteria are in perfect agreement.

If the chronological consideration were decisive by itself, there would be no mystery about the reason why Eratosthenes and Didymus are not called 'Pythagorean'. If we apply the methodological criterion, on the other hand, there must have been something about their conduct of the science which detached them from the Pythagorean *hairesis* and perhaps connected them more closely with Ptolemy's position. We know too little about Eratosthenes' studies in harmonics to be sure whether this holds of him or not, but a meticulous study of the evidence by David Creese suggests that it probably does.⁵⁵

The case of Didymus is more complex. Creese's examination of Ptolemy's reports about him leads him to conclude that Didymus' innovative ways of using the monochord (Ptol. *Harm.* II.13) were designed only to display the results of his mathematical reasoning, not to test them; they 'involved *epideixis* without empiricism'.⁵⁶ If that were true it would distance him from

⁵⁵ Creese (2010): 178–209. Though he does not focus directly on this issue, his conclusions tend to support the hypothesis that Eratosthenes gave serious weight to empirical evidence as well as to abstract mathematical reasoning.

⁵⁶ Creese (2010): 291. For his discussion of these aspects of Didymus' work see 288–92.

Ptolemy and bring him closer to the Pythagorean 'rationalists', whom Ptolemaïs also identifies with the *kanonikoi* or 'monochord-users' (22.22–23.9). But Creese's arguments are not conclusive, and we cannot ignore Porphyry's startling and enigmatic assertion at 5.11–13, that Ptolemy borrowed repeatedly from Didymus' work without acknowledging the fact. There is no evidence that it bears directly on the point at issue here, or that it does not, but if there is any truth in it Didymus' work cannot have fitted smoothly into a 'Pythagorean' mould.

He stands out from the general run of mathematical theorists in at least two identifiable ways. First, Plato's harmonic construction in the *Timaëus* has the form of a diatonic scale whose tetrachords are divided into two intervals of a tone of ratio 9:8, plus the so-called *leimma* in the ratio 256:243. Philolaus may have adopted this division before him,⁵⁷ and it is the only division presented in the great majority of relevant later sources (e.g. *Sect. can.*, Thrasyllus, Adrastus, Theon, Plutarch, Nicomachus). In view of its ubiquity among mathematical theorists and its Pythagorean or quasi-Pythagorean origins, its adoption might well have struck Ptolemy and Porphyry as one of the trademarks of Pythagorean harmonics.⁵⁸ Ptolemy, however, articulates principles which entail that all the single scalar steps into which a tetrachord is divided must have 'epimoric' ratios, that is, ratios which in their lowest terms have the form $n+1:n$, a rule contravened by the ratio of the *leimma*. His methods also dictate that no two ratios in a given division can be equal, another principle breached by the *Timaëus* system. In these respects Didymus' divisions are in line with Ptolemy's and not with those of the tradition stemming from Philolaus and Plato; apart from Ptolemy himself he is the only theorist known to have followed the rule about epimoric ratios consistently.

Secondly, the title of the work by Didymus from which Porphyry quotes, *On the difference between the Aristoxenians and the Pythagoreans*, implies that its main purpose was not to expound its author's own contributions to the science, but to compare the theories of the two major schools of thought. Porphyry's allusion to Didymus at 3.13–14 and the passages he quotes at 26.6–28.26 fit squarely into that agenda, and the passage paraphrased at 107.15–108.21 is also a report about the procedures of others (in this case Pythagoreans), not of ones adopted by Didymus himself. All this material is presented in tones of detached objectivity, and he gives no sign of aligning

⁵⁷ See Huffman (1993): 149–50, Barker (2007): 268–9, 272–5.

⁵⁸ But this cannot be directly confirmed. When Ptolemy mentions this division in *Harm.* I.16, he does not represent it as a brainchild of Pythagorean theorising but as a practical musician's anomalous (though forgivable) deviation from theoretical correctness.

himself with the Pythagoreans; from the evidence of 26.6–28.26 one might indeed judge that he found more food for thought in Aristoxenus' ideas than in theirs. He may, then, have been a writer who gave his own harmonic constructions only a minor role in his work and devoted most of it to researches in the science's history; hence he could not be neatly docketed as a Pythagorean or an Aristoxenian, or as the founder of a *hairesis* of his own.⁵⁹

The term 'Pythagorean' seems therefore to be reserved for two groups of harmonic theorists. There are first the early pioneers in the tradition stemming from Pythagoras himself, which was generally thought to have ended with Archytas. By this criterion Archytas would naturally have been thought of as a Pythagorean theorist, and is regularly called a Pythagorean in the later sources,⁶⁰ even though his methods and the form of his harmonic divisions distance him significantly from the post-Platonic Pythagorean consensus.⁶¹ The second group are those of any date who relied (with some minor qualifications) on mathematical reasoning alone in the construction of their systems, whose divisions did not assign epimoric ratios to all scalar intervals and typically followed the pattern laid down in the *Timaeus* and the *Sectio canonis*, and who used the monochord and the evidence of the ear only to put their constructions on display, not to submit them to experimental tests.

In the opposite corner we have the Aristoxenians. Broadly speaking, they are characterised by their doctrine that harmonics is concerned only with audible sounds as such, and not at all with their physical causes; by their representation of musical intervals as quasi-linear distances between points, not as ratios between quantities; and by their insistence that all the principles of the science must be grounded in the evidence of sense-perception and not of abstract reasoning. Reasoning still has a significant role in their project, but its main task (as in Book III of the *El. harm.*) is

⁵⁹ Despite the importance with which Porphyry credits him, he includes no '*hairesis* of Didymus' among those listed at 3.6–8.

⁶⁰ In his own period he is assimilated to the Pythagoreans when his harmonic theories are under discussion, but not in other contexts: see Huffman (2005): 8.

⁶¹ Porphyry's treatment of Archytas is intriguing. He was well known as a member of the early Pythagorean tradition, and Ptolemy describes him as 'of all the Pythagoreans the most dedicated to the study of music' (*Harm.* 30.9–10). But when Porphyry comments on this passage he describes him in a phrase whose natural sense is not that he *was* one of the Pythagoreans but that he came *after* them (139.13); yet at 56.2–3 he follows the normal practice and calls him 'Archytas the Pythagorean'. Perhaps his ambivalence about giving him the title reflects his recognition that when Ptolemy, Ptolemais and Didymus discuss Pythagoreans in general, their remarks apply principally to the 'rationalists' of my second group, and that Archytas' work in harmonics had very little in common with theirs.

to draw out and demonstrate what follows from the principles, once they have been empirically established.

All these aspects of their approach are prominent in the *El. harm.*, together with others that Porphyry also discusses, and it is clear that when Ptolemy and Porphyry refer to 'the Aristoxenians' they almost always have Aristoxenus himself primarily or even exclusively in mind. Porphyry quotes from his writings repeatedly, and cites no other Aristoxenian source,⁶² and neither author mentions any other Aristoxenian by name.⁶³ But both of them regard Aristoxenian harmonics as a living presence in their own time, and in two passages (130.28, 137.13) Porphyry follows Ptolemy in referring to contributions made or errors committed by 'the more recent Aristoxenians'.⁶⁴ In several other cases (e.g. 95.13–19) he clearly has contemporary Aristoxenians in mind, though he does not say so explicitly.

These hints about Aristoxenians in the imperial period are tantalising, since we know very little about such people,⁶⁵ and it is not just Ptolemy and Porphyry who name no individual Aristoxenian theorists. Many Latin and Greek writers from the Hellenistic period onwards show at least an elementary knowledge of Aristoxenian thought, but none of them names any Aristoxenian authority except Aristoxenus himself. The fact that this knowledge was so widespread, and that the writers never mention the sources that provided it, points to the conclusion that the 'more recent Aristoxenians' exerted a pervasive cultural influence, but did not convey their views in writing. My best guess is that they were primarily school-teachers. Writers may also have supplemented their instruction through conversations with professional musicians, who could naturally discuss their art in Aristoxenian language, whereas for their purposes the concepts and terminology of mathematical harmonics were virtually useless. Both the influence and the anonymity of contemporary exponents of Aristoxenian harmonics would be readily explained if the subject was regularly taught in schools, and there is little doubt that it was. Several of the little 'handbooks' of harmonics (e.g. those of Cleonides, Bacchius and

⁶² Two short phrases giving alternative Aristoxenian definitions of a note are quoted anonymously at 86.8–10; they both differ slightly from one offered at *El. harm.* 15.15–16, and probably represent later attempts to improve it.

⁶³ What Porphyry tells us of Arcestratus at 26.27–27.16 seems to align him loosely with the Aristoxenian tendency, but he does not call him an Aristoxenian. At 3.6–7 he implies that he founded a *hairesis* of his own.

⁶⁴ Both these allusions, despite their brevity, preserve information which is not found elsewhere.

⁶⁵ Cleonides' *Harmonics* and Book I of Aristides Quintilianus are largely compendia of Aristoxenian doctrine, and they are our best sources for material that is not in the surviving texts of Aristoxenus himself. But they give only tiny scraps of information about later developments in the tradition.

Gaudentius) were evidently designed as school texts,⁶⁶ and at least two relevant passages of Porphyry's commentary (83.25–84.5, 95.13–19) depict scenes in the classroom or the lecture-hall. Music-teachers must themselves have been taught by musicians, and the innovations attributed to 'more recent Aristoxenians' by Ptolemy and by Aristides Quintilianus seem likely to have been prompted by practical rather than purely theoretical considerations; they were probably introduced by professional performers, in order to incorporate new developments in performance and composition into the theoretical framework with which they were familiar.⁶⁷ Scholars like Porphyry clearly studied the writings of Aristoxenus himself as well as recalling what they had learned in school, but I suggest that it was through the school curriculum that modified forms of Aristoxenian theory reached them and others, and remained a live point of reference in educated circles. Some additional comments bearing on these issues are offered in subsections 5(d) and 5(e) below.

(b) *The monochord*

Most of the snippets of factual information that Porphyry offers without reference to earlier writings are slight and incidental, and show little more than general knowledge of a sort displayed by many writers of this period, specialists and non-specialists alike. But this is not true of his discussion of the monochord in I.8, where he follows Ptolemy's account faithfully, step by step, but also provides a good deal of detail that the *Harmonics* does not. One might not have expected this abstractly minded intellectual to have been so intimately acquainted with the instrument and its deployment, especially in its practical aspects, and the information he gives adds significantly to our knowledge.

He specifies, for instance, the materials of which the instrument and its bridges are made (wood for the instrument, horn for the bridges). He seems to imply that the first step is to draw precisely measured indications (lines and circles) on the surface of the instrument's sound-board, to mark the positions of its various other components – as a competent craftsman surely would. He is aware that the bridges should not be simply spherical, as one might incautiously (and wrongly) infer from Ptolemy's description,

⁶⁶ They were presumably intended to provide teachers with a framework for their lessons. It would have been much too costly to make copies of the texts and distribute them to the pupils themselves.

⁶⁷ The innovations involved new divisions of the tetrachord (Ptol. *Harm.* 29.9, repeated at Porph. 137.13), and the addition of two new *tonoi* ('keys') to Aristoxenus' set of thirteen (Arist. Quint. I.10, 20.5–9, cf. Ptol. *Harm.* 59.6–20).

but should be cylindrical ‘up to a certain point’; only the upper surface is a section of a sphere. He suggests a surprisingly large diameter (three finger-breadths) for their bases, and allows us to infer from this the instrument’s approximate width. He notes that the *kanonion* (the measuring-strip) used in association with it should be lighter and narrower than the instrument, and a little longer than the sounding-length of the string; and he describes how it is to be marked out and associated with the string with meticulous attention to the minutiae, as if guiding the hand of a novice at every step along the way.⁶⁸ All this encourages the conclusion that he had himself been trained in the instrument’s use, or at least had learned very carefully how others constructed and used it, and that he thought it important that his readers should thoroughly understand the procedures. But though his apparent expertise enables him to elaborate Ptolemy’s account substantially, nothing he says is at odds with it. So far as the texts can show, there is no difference between Ptolemy’s monochord and the instrument that Porphyry describes, or between the ways in which they expected it to be used. Their accounts differ only in so far as Porphyry tells us a good deal more. We may reasonably infer that the version of the monochord with which Ptolemy was familiar, his procedure for testing the string’s properties, and so on, were not peculiar to him or his immediate milieu. Whether or not they had been widely used by students of mathematical harmonics in the second and third centuries, Porphyry knew them at first hand, and he evidently believed that they should be so used, especially, perhaps, by Neoplatonist and Neopythagorean philosophers.

(c) *The tonoi and the attunements of musical performers*

This example alerts us to the extent of Porphyry’s familiarity with some of the more practical aspects of a harmonic scientist’s activities. Problems posed by one of the commentary’s most difficult chapters may put us on the track of another dimension of his musical knowledge. In II.1 Ptolemy supplements the theoretical account he gave in I.16 of the patterns of attunement used by contemporary musicians. What he now offers is a set of procedures for reaching the same conclusions on a more concrete basis. It involves tuning an instrument’s strings by ear, as a performer would, to each of the attunements that professional musicians used, and comparing one with another in certain rather intricate ways. To clarify the steps of the procedure, Ptolemy gives each of the attunements the

⁶⁸ On some of these points and on issues affecting geometrical precision see Creese (2010): 308–10.

name by which musicians knew it, and names the notes that each of them includes. Although the details of his constructions are almost unintelligible unless we also know in which *tonos* or 'key' each attunement is set, he does not identify the relevant *tonoi* here; he will specify them in II.16, after presenting his wider discussion of the topic in II.7–II. Porphyry, however, in his commentary on the passage, while occasionally mentioning the names that Ptolemy provides, makes a point of identifying each tuning by reference to the *tonos* in which it is set. Although, like Ptolemy, he has not previously discussed the *tonoi*, he apparently supposes that his allusions will be understood. This by itself might cause some surprise, since the concept of *tonos* is one of the most problematic and controversial in the harmonic theorists' repertoire.⁶⁹ But it seems still stranger that the *tonoi* in which he places the attunements are different from those to which Ptolemy later assigns them (several of them do not figure in Ptolemy's system of *tonoi* at all), and so are the names of their constituent notes.

The differences are too consistent and substantial to be the result of carelessness or scribal confusion; and so far as I am aware, the only scholar who has found a plausible explanation for them is Stefan Hagel.⁷⁰ I cannot go into its intricacies here, but the gist of it is this. The system of *tonoi* which Ptolemy describes and defends in *Harm.* II.8–II was eccentric even in its own time. It was motivated by theoretical considerations which – in Ptolemy's view – dictate the proper purpose and form of a system of keys, and it is quite different from the set of *tonoi* that musicians actually used. His system and theirs differ in the number of *tonoi* they recognise, in the names by which they designate them and in the identity of the *tonos* which counts as the basic or central key.⁷¹ On the other hand there is no good reason to doubt the accuracy of his analyses of the forms of attunement the musicians used,⁷² even though they might have been puzzled by the peculiarities of the system of *tonoi* into which he absorbs them in II.16.

Porphyry implies, however, that this group of attunements had not survived unaltered into his own time. 'On the contrary', as Hagel remarks, 'he seems to infer that the practice of Ptolemy's time was quite different' from that of his own musical milieu.⁷³ We might therefore be tempted

⁶⁹ For a clear exposition of its main features see West (1992): 228–33, and cf. e.g. Barker (1989): 16–27 and (2007): 215–28.

⁷⁰ Hagel (2009): 61–5. Readers should note that this discussion cannot be well understood in isolation from – at least – the rest of the chapter in which it appears.

⁷¹ For a brief but more carefully nuanced account see Hagel (2009): 56–61. Ptolemy is a major presence in Hagel's book, however; see his Index of Personal Names for further references.

⁷² On this point see Barker (2000): 150–5, 255–8.

⁷³ Hagel (2009): 63, cf. 65.

to guess that his strategy was not merely to avoid using the attunements' names (which had by now become meaningless or misleading) as the main indicators of the attunements' identities, clarifying his descriptions instead with references to the *tonoi* in actual use. Perhaps, one might suppose, he was trying to recast Ptolemy's account in such a way that it no longer described the same forms of attunement, and corresponded instead to ones that chimed with the practices of his own contemporaries. But this hypothesis is untenable, since he makes it quite clear that it is Ptolemy's attunements that he is trying to describe. The *tonoi* in which he has placed them are those which people 'most commonly used to employ' (156.9); and Hagel argues that the past tense, 'used to employ', must imply that they are ones which had been regularly used in Ptolemy's time but had little or no place in the practice of his own contemporaries. What he was attempting, in Hagel's opinion (if I understand him correctly), is to represent the attunements used, according to Ptolemy, in second-century Alexandria, but to do so in terms with which his own third-century contemporaries – perhaps primarily in Rome – were familiar, that is, by reference to structures which played essential roles in their own conceptions of key-relations.

At the end of his passage on Porphyry, Hagel notes that his interpretation leaves certain problems unresolved. That is true, but if it is on roughly the right lines (as I believe it must be), we can conclude that Porphyry's musicological knowledge extended beyond anything he could have gleaned from Ptolemy himself, or from the other sources he cites in the course of his commentary. He knew that Ptolemy's account of the *tonoi* was out of step with those of the musicians of the period in which the *Harmonics* was written, and with the views of the theorists of that period; and he knew enough about the ways in which his own contemporaries represented the *tonoi*, and the theoretical framework in which the attunements they used were embedded, to tackle the task of elucidating Ptolemy's analyses in II.1 in a way which his readers would find intelligible.

(d) *Continuous and intervallic sound*

As Aristoxenus represents it, a 'continuous' sound (or a continuous 'movement of the voice', in Aristoxenus' language) is one that slides up or down in pitch without staying on any one pitch for a perceptible length of time; a 'divided' or 'intervallic' sound is one that moves through a sequence of determinate pitches, coming to rest on each of them and separating them by intervals over which it passes instantaneously and in silence. Almost all later discussions of the distinction are based on the account given by

Aristoxenus,⁷⁴ and the writers repeatedly tell us, as he does, that the former is used in speech and the latter in music. Though they often abbreviate his exposition and sometimes use different terminology, they rarely modify it in ways that significantly affect the sense. Ptolemy's treatment is at *Harm.* 10.5–18; Porphyry tackles it twice, at 9.34–10.27 and 83.1–85.33 (to which 86.1–87.19 is also relevant). His discussions have different purposes: the first presents the views of the Aristoxenians, while the second is designed to elucidate Ptolemy's exposition. They are not wholly consistent with one another, and each of them has intriguing quirks of its own.

The 'Aristoxenian' account departs in several unusual ways from the one presented in the *El. harm.* First, its description of a continuous sound gives as one of its defining features the rapidity and haste with which it moves between pitches (10.5, 10, 20–7), whereas Aristoxenus says nothing to suggest that the movement's speed has any bearing on the matter.⁷⁵ The fact that Porphyry's Aristoxenians apparently thought it relevant is indeed rather puzzling, since the distinction between the two forms of movement, as it is represented elsewhere, hangs only on the manner in which a sound's pitch changes and not at all on the speed at which it does so. Again, there is no fixed line to be drawn between quick and slow, and if very quick movement makes a sound continuous and very slow movement makes it intervallic, there will presumably be an intermediate range of cases in which it cannot definitely be said to be either. But in other sources the distinction is regularly treated as absolute – a sound's movement is either continuous or intervallic, and there are no intermediate cases in which its status is ambiguous.⁷⁶

Secondly, Porphyry reports the Aristoxenians as asserting that the pitches between which an intervallic sound moves are separated by silences (10.14–16). But this is something that Aristoxenus explicitly contradicts: in respect of time, he says, the movement is continuous – that is, there is no temporal gap between its departure from one pitch and its arrival at the next.⁷⁷ Here again Aristoxenus' version seems preferable, at least if we take into account his repeated insistence in this passage that he is speaking only of the phenomena as they appear to sense-perception. We can at any rate

⁷⁴ *El. harm.* 8.13–10.20.

⁷⁵ The speed, *tachos*, of these transitions is also mentioned in Arist. Quint. I.4, at 6.1 Winnington-Ingram.

⁷⁶ This is not entirely accurate; a few writers mention an intermediate form of movement, but it is rarely discussed, and never characterised by reference to the movement's speed. See especially Arist. Quint. 5.24–6.7, which describes it as a combination of the other two forms of movement, and says that people use it when they read poetry aloud.

⁷⁷ *El. harm.* 8.27–30.

agree that there *need* be no detectable periods of silence between the audible pitches of an intervallic sound, and hence that there should be no reference to such silences in a definition of this mode of movement.

We should not conclude, however, that these divergences from Aristoxenus arise from mere misunderstandings, either on Porphyry's part or on that of the anonymous Aristoxenians whose views he is recording, since the passage contains a clue which allows us to interpret them in a less critical spirit. After discussing the two forms of movement, Aristoxenus mentions that the intervallic form is proper to singing and the continuous form to speech, but he does not elaborate further. By contrast, Porphyry's report on the Aristoxenians draws attention to their different roles right at the start, and he devotes nearly half the passage (10.15–27) to graphic descriptions of certain faults that can creep into speech and musical performance; they do so when the way in which the voice moves between pitches in either mode of performance approximates too closely to the form of movement proper to the other. People who stammer and break up their speech into fragments are behaving more like singers – and, he says, we criticise them for it – and although musicians who sing very fast may believe that they are doing something skilful and splendid, they in fact disgrace themselves by coming too close to the mode of performance appropriate to speech.

This account focuses attention, then, not just on the nature of the two forms of movement, as Aristoxenus does, but also on certain specific kinds of case in which they occur; and by condemning these occurrences on aesthetic grounds it steps outside the familiar business of describing the movements' characteristics and offering examples. But there is no reason to suppose that Porphyry is reporting the Aristoxenians' views inaccurately, or that he is misrepresenting their attitude when he uses the distinction as a basis for evaluative judgements. Let us assume that these Aristoxenians are later representatives of the tradition, as they must be if Porphyry's report is reliable. Then if the hypothesis I suggested above is on the right lines, they will be teachers – in this context specifically singing teachers, and perhaps also teachers of elocution. In that case the association of an objective distinction with criticisms of modes of performance becomes perfectly natural. A student who has set himself the goal of singing as quickly as possible must be reined in, and this might well be done by showing him that he is aiming at something inappropriate to the art he is trying to master. After all, a student's efforts at performing very rapid runs are indeed likely to degenerate into slithering glissandi, whose musical undesirability the teacher can explain by appeal to the distinction between the two forms of vocal movement. Rather similarly, though the suggestion that the distinctly

pitched notes of a musical performance should be separated by silences is theoretically anomalous, such separation makes sense as a technique for students to practise, to inculcate in them the otherwise unfamiliar habit of giving each pitch clean boundaries, avoiding any audible contact with the pitches between them. A teacher of elocution or rhetorical delivery, by contrast, would wish to discourage his students from breaking their utterances up into discontinuous fragments.

Porphry does not criticise these Aristoxenians' views directly, but in the passage at 83.1–85.33, where he discusses and writes approvingly of Ptolemy's account of the distinction, the two major peculiarities we found in the Aristoxenian exposition have disappeared. The continuous form of movement is examined at length and copiously exemplified, but this time the speed of its transition between pitches is apparently deemed irrelevant, since Porphyry says nothing about it; and he explicitly denies that the pitches of what he now calls a 'divided' sound must be separated by moments of silence. Such sounds, he says, are not those divided by silences, but those whose constituent pitches are clearly defined and do not run together; they are like patches of pure colour set side by side (85.6–9). In these respects at least, the position he (correctly) attributes to Ptolemy is much closer to that of the *Elementa harmonica* than the one previously attributed to the Aristoxenians.

His expansion of Ptolemy's short discussion and the interpretations he puts on unfamiliar features of Ptolemy's terminology are by and large faithful to the original and helpful as guides to its meaning. But there is independent food for thought here too. In the first place it begins, as no other passages on the subject do, with a brief study of continuity and discontinuity in general (83.1–10), thereby assimilating the specialised musicological contrast between 'continuous' and 'divided' sounds to debates that had been on-going among philosophers since the Presocratic era, prompted from the fourth century onwards especially by discussions in Aristotle's *Physics* and *Metaphysics* and fuelled by controversies between Epicureans and Stoics. I shall argue in Section 7 below that Porphyry intended his commentary primarily for the instruction of philosophers, and this is a compact example of the efforts he makes to integrate musicological with philosophical thought.

It is interesting, too, that he devotes a surprisingly large proportion of the passage (83.13–84.29) to the topic of continuous sound, that is, to the kind of sound that has no place in music. No other musical theorist pays it so much attention. But some programmatic statements much earlier in the commentary explain why Porphyry thought it proper to treat it at

greater length. Harmonics, he says, is primarily concerned with the nature of sounds that are musically attuned, but also, secondarily, with those that are not; and it studies not only intervallic sounds but also those that are continuous, in order to distinguish the former as clearly as possible from the latter. 'For in general,' he continues, 'all branches of knowledge and all skills apprehend not only the things in their own domain but also those round about them, though they deal with the former primarily and with the latter subordinately' (6.17–29). Hence a careful study of continuous sound is not inappropriate to the subject. In fact, however, his abstract statements about it are fairly perfunctory. Most of the passage is occupied with examples, some of them quite graphically and elaborately developed, notably in his description of the sound of the 'trumpets that mark the hours' (83.19–24) and his heart-rending vignette of a singing-student's desperate efforts to pitch the note that his teacher had given (83.25–84.5). These examples are not found in our other sources, and it seems likely that they are based on Porphyry's personal experience.

A particularly intriguing issue emerges from Porphyry's treatment of one of Ptolemy's analogies. Ptolemy says that sounds whose pitch changes continuously are those 'the locations of whose movements in each direction are not clearly apparent, or of which no single part is equal-toned over a perceptible interval of time, as with what happens to the colours of the rainbow' (*Harm.* 10.6–8). He apparently regards the two formulations as alternative definitions of the same phenomenon; they are not linked by the word 'and', which would indicate that a continuously changing sound must satisfy both conditions, but by the word 'or', which identifies the definitions as alternatives. Yet they plainly are neither logically nor empirically equivalent. In a sound whose movements from pitch to pitch are indistinct or blurred, there could, consistently with the first definition, be stretches of time in which the pitches themselves – those between which these movements take place – remain stable and clearly identifiable. But that would be inconsistent with the second definition. Porphyry too seems to notice no difficulty in the relation between the two definitions. He repeats the second, 'of which no single part is equal-toned over a perceptible interval of time', at 84.21–2; and in explicating it he says that in sounds of this sort there is in fact a part that is constant in pitch for a certain length of time and a part that is changing, but that this is 'not made clearly apparent'. This curious suggestion, which is not in Ptolemy, does not resolve the problem. Ptolemy's first definition still leaves open the possibility that the pitches between which the movements take place are perceptibly stable. Porphyry compounds the difficulty when he picks up

Ptolemy's analogy. The case of continuous sounds, he says, is like that of the rainbow, in which the various colours are *perceived* as being constant over a certain distance. It is only their boundaries that are indistinct and blend into one another in a way that sense-perception cannot grasp (84.20–8).

In the rainbow, as Porphyry describes it, we do see each colour as staying constant over a certain area, and it is only the boundaries between the colours that are blurred. In the corresponding case, then, as he says in the preceding lines, there will be lengths of time during which the sound's pitch remains perceptibly the same; but the pitches blend into one another at the edges, and it is impossible to detect any exact point at which one of them ends and the next begins. This thesis is plainly at odds with the second part of Ptolemy's statement, in which no part of the sound maintains a steady pitch for any perceptible length of time. It also seems inconsistent with what Porphyry says himself at 83.17–18 and again at 84.3–5, where his remarks imply that there are no periods of time at all – whether they are perceptible or not – in which such a sound stays steadily on one pitch. On the other hand what Porphyry says about the rainbow itself seems perfectly accurate. When we look at a rainbow its colours appear in stripes each of which has a definite hue over most of its area, but whose edges are indistinct and blurred; and we might reasonably suspect that it is Porphyry's own observations of rainbows that have enticed him into this elaboration of the analogy, that he has allowed them to shape his thesis about continuous sounds, and that he has failed to notice its dissonance both with Ptolemy's second way of defining these sounds and with his own previous statements.

But this is not the end of the matter. Three pages later, at 87.9–13, in one of the rare cases where he criticises Ptolemy explicitly, Porphyry complains that his definition of a note as a sound that maintains one and the same pitch is inaccurate, since it will also include 'continuous vocal sound' and 'the parts of simple sounds that are not produced melodically'. What he means by 'continuous vocal sound' (or 'voice', *phonē*) becomes clear immediately; the phrase refers to the enunciation of spoken words, the paradigm case of 'continuous' sound; one can apply Ptolemy's definition, he says, to the high-pitched and low-pitched syllables of a spoken word. He offers no argument in support of this contention, presumably because its truth would be obvious to anyone who listened to the contours of speech; and we must apparently conclude that in the spoken Greek of Porphyry's time, the syllables maintained stable pitches over some perceptible part of their duration, while shading into one another at the edges like the colours of the rainbow. We may note that Aristides Quintilianus defines continuous sounds only by reference to the vagueness of their transitions

between pitches and says nothing to suggest that the pitches between which they move are themselves unstable; that Bacchius represents the pitches between which the sounds of speech move as *phthonggoi*, notes; and that in an earlier period Dionysius of Halicarnassus had described each spoken syllable as being 'placed on' (*tattomenē epī*) a high or a low pitch.⁷⁸ All these are consistent with Porphyry's picture of Greek speech, and those of Porphyry, Bacchius and Dionysius are incompatible with the description given by Aristoxenus, which denies to the pitches of spoken utterance any moments of stability at all. Porphyry's evidence is the most clear cut, and with the support of the others it suggests rather forcefully that the way in which Greek was spoken changed in this respect at some time in the period between Aristoxenus in the late fourth century BC and Dionysius in the first; for another suggestion, see Barker (forthcoming): 136–7.

(e) *Melody as 'broken sound'*

Porphyry returns to the distinction between continuous and intervallic sounds in the course of the next passage, where he examines various definitions of a note, *phthonggos* (86.1–87.19). Among them are two Aristoxenian definitions, both of which say, in part, that a note is the incidence of a voice (or sound) on a pitch. But the word I have translated as 'incidence', *ptōsis*, means literally a 'fall'; and at 86.16–24 Porphyry offers some curious comments on this usage. Continuous sounds, he says, as it were stand firm; but intervallic sounds do not stay upright, and by being broken and falling they become melodic. Just as a tree that stands upright is in a sense continuous, whereas one that is broken by a gale falls, so a continuous sound is upright and unbroken, and sounds become melodic when they have fallen in ruins.

By describing continuous sound as firm and upright, and intervallic sound as broken, collapsed and wrecked, Porphyry seems to represent the former as sound in its correct or perfect condition and the latter – the one required in melody-making – as lamentably damaged. This strikes a very harsh note in the context of musical theory; and in the statements I have paraphrased, Porphyry gives no indication that his descriptions are based on anything but his own reflections on the word *ptōsis*. But in the middle of the passage (86.19) he inserts another brief remark: 'that is why they call

⁷⁸ Arist. Quint. 5.26–6.2, Bacch. 69 (307.11–14 Jan), Dion. Hal. *De comp. verb.* 11, Cleonides (*Harm.* 2, 180.13–16 Jan) incorporates both of Ptolemy's definitions, but unlike Ptolemy he implies that the movement of a continuous sound, identified with that of speech, must satisfy both conditions: it 'makes its rises and falls in pitch indistinctly, standing still nowhere until the point of silence'.

melody “fragmentation of the voice (*klasis phōnēs*)”. This is most naturally taken to mean that the phrase ‘fragmentation of the voice’ was a common description or definition of melody; and Porphyry may have intended to imply that the remarkable picture he has painted was one regularly used to explain the familiar phrase.

The difficulty is that we have no other evidence that melody was commonly called ‘fragmentation of the voice’, and only one pitifully inadequate indication that the phrase was ever used in this sense. The only other passage that uses a phrase of this sort to refer to melody in general, or to the kind of vocalisation involved in melody as such, is in the collection of fragments known as *Excerpta neapolitana* (at 413.2–4 Jan), a source of unknown date and dubious authority. Quite probably its remark is a mere echo of Porphyry himself. In other writers such phrases always refer to melody of a particular, highly modulated sort, and always in tones of disapproval.⁷⁹ LSJ finds the sense that Porphyry gives it in certain passages of Philo of Alexandria, and his usage at *De posteritate Caini* 106.1–2 might indeed be thought to resemble Porphyry’s. But this would be a mistake; it too refers specifically to complex and modulated melody, and so do the occurrences at *Quod deus sit immutabilis* 25.2–4 and *De sacrificiis Abelis et Caini* 23.4–5.

Porphyry’s depiction of intervallic sound here is strikingly unorthodox, and we may be inclined to dismiss his statement at 86.19 as simply untrue. But it can be read in another way. Perhaps when Porphyry says ‘they call melody “fragmentation of the voice”’, without specifying who ‘they’ are, he is not referring to people in general, but only to those whose theories are currently under discussion. In that case they must be the Aristoxenians, since it is an element of their definitions that has provoked this excursus. If we accept my hypothesis that Porphyry’s Aristoxenians (other than Aristoxenus himself) were not writers but teachers or performers, the absence of written examples of the usage becomes less mysterious. They might also, perhaps, have been responsible for the allusions to wrecked and fallen trees and so on; one can imagine a teacher using such colourful analogies in the classroom. I think this may be the right interpretation, but it does not completely solve the problem. If what Porphyry says had been regularly current in schools of the period, we would expect some examples of it to have found their way into the surviving literature on melody and the differences between melody and speech; much has of course been lost, but we still have plenty of it. A fully satisfying solution remains elusive.

⁷⁹ See e.g. [Plut.] *De mus.* 1138c, Philo Alex. *De agricultura* 35, Schol. in Aristoph. *Nubes* 969c, 971d, Sext. Emp. *Adv. math.* VI.15.

In this section I have tried to highlight some of the commentary's musically interesting passages other than those contained in Porphyry's quotations. Of course the latter must take pride of place, but in the past Porphyry's own contributions have been unduly neglected. The examples I have offered are only a selection, and readers who examine the whole text will certainly find more.

6 The circumstances in which Porphyry's commentary was composed

The question, considered in Section 7 below, why Porphyry not only studied Ptolemy's *Harmonics* but also published a commentary on it is bound up with another, more general issue. In what circumstances is such a commentary likely to have been composed, and what did its 'publication' involve? The hypothesis I want to propose draws heavily on the work of William Johnson, and especially on his recent book *Readers and Reading Culture in the High Roman Empire* (Johnson (2010)). He does not discuss the genre of commentary, but some of his rich and fascinating observations and conclusions suggest plausible ways of envisaging the processes through which commentaries, including Porphyry's, were constructed and disseminated.

Johnson shows that around major writers of the period he considers, Pliny the Younger, Tacitus, Galen, Aulus Gellius and others, there gathered groups of people anxious to establish their credentials as members of a cultural elite by joining in learned discussion under a distinguished intellectual's leadership. Such gatherings were common, in some cases almost daily, sometimes over a meal and sometimes in other situations. The basis for discussion was typically provided by a book, which might be a new work by the group's leader or another contemporary author, or an acknowledged literary or scholarly masterpiece. This was read aloud to the group. But in Pliny's circle, for instance, the book was not read right through before discussion began; instead, after a short passage, perhaps just a single sentence, the reading would pause, and the group's leader would discourse on the passage's linguistic, literary, philosophical, historical, scientific and other qualities, and on problems and issues that it addressed or provoked. In Pliny's entourage, again, though not in all others, it was expected that his associates would also contribute to the discussion when the master⁸⁰ had

⁸⁰ We may note the use of the word *didaskalos*, 'teacher', to designate the principal figure in an erudite group of this sort, for instance the patron and host on the (no doubt fictional) occasion described in [Plut.] *De musica* (1131B, E, 1146C, D). It is obvious that the context is not that of a formally constituted educational establishment.

finished, especially by offering apposite quotations from other sources and elaborating on their significance. It was in this way that they confirmed, to themselves and others, the legitimacy of their claim to the elite status that membership of the group conferred.

This seems a very likely model for the process through which a commentary was constructed and developed. Most commentaries, Porphyry's included, take precisely the form described: short excerpts from the work being read, each followed by learned discussion of issues arising, often studded with quotations from other sources. It is clear that in later life Porphyry was the central figure in a close-knit group of intellectuals; and whether or not the group was formally constituted as a 'school' with Porphyry at its head, it seems very probable, given the wealth of evidence that Johnson has compiled, that the procedures they adopted replicated those of the 'reading communities' that he examines. In that case, though the bulk of the commentary was probably the product of Porphyry's own solitary studies, just as the magisterial pronouncements of other groups' leaders formed the principal part of their discussions, we cannot exclude the possibility that some of it – and perhaps some of its more puzzling diversions and incongruities – arose from interventions by other members of his circle.

When discussion in such groups was focused on a new work, not as yet publicised beyond the group's boundaries, part of its function from the author's point of view was to show him whether it was likely to be well received if it were released to a wider readership. If he decided in its favour, dissemination of this sort sometimes, at least initially, took the form of a recitation of the work in a larger, more public gathering; but this seems unlikely in the case of a commentary such as Porphyry's. Beyond or replacing that starting-point, as Johnson says, "Publishing" (*emittere, edere*) was simply the offer to let others copy your literary work without stipulating that they keep it to themselves.' The author might also promote it more positively, by dedicating it and presenting a copy to some influential person who – he hopes – will encourage his own friends and associates to take note of it; in the first line of his commentary Porphyry dedicates his work to a certain Eudoxius (whose identity is unknown), and he may have had similar motives. Since there were no publishers who acted as 'gatekeepers' (Johnson's expression), determining which books would see the light of day, the extent of a work's exposure depended entirely on whether people outside the author's immediate circle decided to have copies made and to let others read them – and perhaps to re-copy them too. The outcome was obviously beyond the control of the author, but membership

of one of the groups would improve his chances; 'the only clear route to recognition as an author was by attachment to, and promotion by, one of these circles'.⁸¹

I can offer no direct evidence that Porphyry's commentary was built upon the reading and discussion of Ptolemy's text along with a circle of associates. Perhaps we can detect a loose parallel in the impression that Porphyry gives of procedures adopted in the group around Plotinus, for instance in *Vit. Plot.* 18. But if my hypothesis is anywhere near the truth, we might tentatively draw four main conclusions. First, it increases the probability that the commentary is a product of the later part of Porphyry's career, when he held the dominant position in his group. Secondly, its contents may not all have emerged directly from his own fund of learning and his own reflections; other members of the group may have made significant contributions. Thirdly, it need not have been composed with a view only, or mostly, to the instruction of people formally enrolled as Porphyry's students, if indeed he had any; he may have intended its presentation to the group, in a preliminary form as *viva voce* comments inserted between readings of Ptolemy's text, primarily as a step along the route to its wider dissemination. But finally, the scenario presupposes that the members of his circle would have considered an examination of Ptolemy's *Harmonics* a worthwhile enterprise, and perhaps one to which they themselves might have something to contribute. This last conclusion leads us to the topic of my next section.

7 The purposes of the commentary

Why did Porphyry write a commentary on a musicological text, and what kinds of reader was he hoping to enlighten? We know, of course, that Plato had prescribed harmonics as one of the mathematical disciplines that potential philosophers should study, and that Neoplatonists in general took a lively interest in musical theory;⁸² Porphyry tells us that Plotinus himself had a sound grasp on the subject.⁸³ But philosophers (or apprentice philosophers) setting out on harmonic theory for the first time would not have been well served by a scholarly and sophisticated commentary on an outstandingly difficult text, and I think that Porphyry must have had some other purpose in mind.

⁸¹ The quotations and much of the content in this paragraph come from Johnson (2010): 52–3.

⁸² Cf. e.g. Gersh (1992): 141.

⁸³ *Vit. Plot.* 14: 'He had a thorough theoretical knowledge of Geometry, Mechanics, Optics and Music, though it was not in his temperament to go practically into these subjects' (tr. MacKenna).

When we consider the demands the commentary makes on its readers, the following points stand out. First, they must be capable of appreciating intricate philosophical arguments and of recognising their relevance to significant debates; and a remark at 53.2–3 indicates that Eudoxius, to whom the commentary is addressed – and who must be broadly representative of its intended readership – had the competence to assess and develop Porphyry's arguments for himself. Secondly, they must be capable of following fairly complex mathematical arguments. But Porphyry seems to credit them with less expertise in this field than in philosophy, since (as we see for instance at 145.7–146.25) they are not expected to be able to fill arithmetical gaps in the reasoning for themselves.

Thirdly, they must already know a good deal about harmonic and acoustic theory, at least enough to understand the conceptual framework within which Ptolemy and Porphyry are working, to follow their discussions intelligently, and to grasp the connections between their contentions and those of the other writers whom Porphyry quotes. We have already noted that they must also have some acquaintance with the ways in which contemporary musicians talked about the details of their art. Finally, and I think significantly, Porphyry seems to assume that they need particularly careful guidance about the ways in which the Aristoxenian and Pythagorean approaches to harmonics differ, about the epistemological, methodological and occasionally ontological positions to which each commits itself, about their respective merits and deficiencies, and about the importance of Ptolemy's achievement in bringing together the best features of both, while avoiding the pitfalls into which each of them stumbles (4.12–16).

The hypothesis which I think fits these facts best is that Porphyry wrote his commentary for the use, above all, of philosophers engaged in studies of Plato's *Timaeus*, in particular for those who concerned themselves with the interpretation of his account of the harmonic structure of the World Soul (*Tim.* 34b–36d). This may seem a perverse suggestion, since Porphyry pays little attention to the dialogue in this work and quotes an excerpt from the passage on the World Soul only once, briefly, at 92.12–18;⁸⁴ and he makes no allusion to the vigorous debates it had aroused on great issues in metaphysics, theology and human psychology. But I think the proposal is worth considering.

Philosophers from the generation after Plato onwards were fascinated by the *Timaeus* and by this passage in particular; discussions and exegeses

⁸⁴ One feature of the construction is mentioned later, at 115.27–116.1, but for Porphyry's explanation of it we are told to consult his other writings; see p. 6 above.

proliferated, and not only among Platonists.⁸⁵ They may not initially have been formal commentaries, but the commentary mode was certainly established by the first century BC, and a substantial number of *Timaeus* commentaries had appeared before Porphyry's time, notably those of Thrasyllus, Adrastus and the writer whom Porphyry calls 'Aelianus the Platonist'. Plutarch's essay *On the Generation of the Soul in the Timaeus* is also in effect a commentary on the relevant part of the dialogue; so too, in large part, is the surviving remnant of Theon of Smyrna's *Mathematics Useful for Reading Plato*, in which extensive quotations from Thrasyllus and Adrastus are embedded. Porphyry wrote a commentary on the *Timaeus* himself, of which fragments survive, and the huge commentary of Proclus in the fifth century AD mentions several others written by Platonists in the intervening period. We can say with some confidence that the *Timaeus* was central to Platonist studies from the first century AD to the end of the Western Empire.⁸⁶

These commentaries and other writings did not confine themselves to the close examination of Plato's text. It becomes clear from the surviving passages that they incorporated large amounts of introductory material, initiating readers into the agenda, the conceptual apparatus and the basic content of established harmonic and acoustic theory. The long passage quoted by Porphyry (33.16–37.5) from Book II of Aelianus' *Commentary on the Timaeus* is a typical example. But there is an interesting peculiarity in the writers' treatments of this material, which can be seen in miniature at 35.14–17 in Porphyry's quotation from Aelianus and in scattered passages of Plutarch's essay, and much more extensively in passages quoted by Theon from the commentary of Adrastus. Of the two main schools of thought in harmonics, the Aristoxenian and the mathematical or Pythagorean, only the latter has any real bearing on the interpretation of Plato's text. Yet these commentaries place definitions, propositions and sometimes quite elaborate discussions drawn from Aristoxenian theory side by side with material on harmonics and acoustics in the mathematical tradition, and the writers give little indication that they conflict in significant ways. Adrastus, like other theorists, points out (on the basis of 'Pythagorean'

⁸⁵ Aristotle and Theophrastus were among the earliest writers on this theme; a later Peripatetic who also addressed it was Adrastus of Aphrodisias, around AD 100.

⁸⁶ Cf. Gersh (1992): 146: 'For a thinker trained in the school of Plotinus, the primary authority of the dialogues and especially of the *Timaeus* is a matter beyond controversy.' But we should note, as an anonymous reader reminds me, that not all the ancient discussions of the *Timaeus*, or of parts of it, took the form of lemmatic commentaries, and that the earlier works on the dialogue to which Proclus, in particular, refers may include writings of several different types, and perhaps even oral lectures.

mathematics) that the Aristoxenian interval of the 'half tone' cannot be exactly half a tone, but he treats the disagreement as a minor issue – one might argue, in fact, on the basis of Theon 71.19–72.20, that in his view it does no damage at all to Aristoxenian theory.

These commentaries' accounts of existing harmonic theories are on the whole quite accurate, and philosophers scrutinising the *Timaetus* who worked with them at their side will have picked up a solid grounding in the subject. But so far as we can tell from the material that has come down to us, they would have learned nothing about the ways in which the two traditions conflict in principle, or about the weighty philosophical implications that a commitment to either of them brings with it. Porphyry finds in Ptolemy a theorist who addresses these issues in detail and at length, and in the earlier, most philosophically expansive parts of his commentary he places them squarely in the foreground. In his introduction he emphasises the importance of Ptolemy's achievement in assessing the merits and defects of each position, though in the course of his discussions he takes care to highlight the fact that Ptolemy's approach has much in common with that of the Pythagoreans, and to play down their disagreements. (Thus at 112.14–19, for instance, he does his best to explain a sustained passage of Ptolemaic criticism as aimed at only one small detail in Pythagorean theory, which it certainly is not.) He joins Ptolemy in his radical denunciations of the Aristoxenians, and enthusiastically elaborates what Ptolemy had said about the incoherence and the unacceptable consequences of their position.

I am not arguing, of course, that the commentary was designed with no one but students of the *Timaetus* in view. It also contains much that would have been interesting and challenging for philosophers working on other Platonic texts, on the relations between Platonic and Aristotelian thought and on the older philosophical tradition in general. Thus Porphyry's comparisons of Aristoxenian and Pythagorean harmonics provide an illuminating point of entry into debates about the 'criterion' – that is, the basis on which judgements can reliably be made – and specifically about the relative status and the roles that should be assigned to sense-perception and to reason in the quest for truth.⁸⁷ The passages he quotes from earlier writers, together with his own reflections, make much more fine-grained distinctions than Ptolemy had done between existing views on these matters, and also lead naturally into wider issues in epistemology. Again, Neoplatonist philosophers would have found plenty of food for thought in the debate

⁸⁷ Ptolemy himself wrote a short work *On the Criterion*; see Huby and Neal (1989): 179–230. But it seems to connect only occasionally and tangentially with issues discussed in the *Harmonics* and in Porphyry's commentary.

he stages in I.3 between Plato and Aristotle, and simultaneously between his own view, which borrows from Aristotle and Theophrastus, and the quasi-Platonist views of Ptolemy and the Pythagoreans. This passage also draws prominently, as we have seen, on Aristotle's theory of categories, which was held to be already implicit in Plato's writings, including the *Timaeus*, from the time of Plutarch onwards.⁸⁸ The evidence of Porphyry's commentary on the *Categories* and of his *Isagoge*, as well as the commentary on the *Harmonics*, demonstrates the importance that he assigns to the theory, and we would expect him to have exploited it again in his commentary on the *Timaeus*. The dialogue offers obvious openings for such treatment, notably in discussions of the relations between the quantitative features of the soul, as Plato represents them, and its non-quantitative attributes and powers, and again between the non-quantitative powers and attributes of the material elements and the geometrical forms that Plato attributes to them. But I have found no trace of such discussions in the surviving fragments. In the *Isagoge*, on the other hand, Porphyry inserts a condensed but quite detailed account of Plato's procedure of collection and division into his essay on the *Categories*, and asserts that it is grounded in ideas that Aristotle articulates.⁸⁹

If my hypothesis is in the right target-area, Porphyry's intended readers would not be 'students' in the sense that they were mere beginners; they would be philosophers with a good deal of learning and experience behind them, whose goal was to interpret the writings of Plato and especially the *Timaeus*. They would already have studied the existing commentaries on the dialogue, from which they would have learned the elements of harmonic theory, but which would have left them uninstructed about the incompatibility of the Aristoxenian and Pythagorean approaches to the subject and their wider philosophical implications. They would, as I have said, be capable of following moderately complex mathematical reasoning, but without being experts in the discipline; in that connection Porphyry's project has something in common with Theon's in his *Mathematics Useful for Reading Plato*, though Porphyry's philosophical intentions are much more ambitious. For his purposes Ptolemy's discussions of the 'criterion', of scientific methodology and of Aristoxenian and Pythagorean harmonics (which he continues to examine right through to I.14) make his treatise

⁸⁸ See Plut. *De an. procr.* 1023E: 'As in these words (sc. *Tim.* 37a5–b3) he is simultaneously giving an outline of the ten categories too, in those that follow (37b3–c5) he states the case more clearly still . . . ' (tr. Cherniss). Similarly Albinus, in the second century AD, asserts that the ten Aristotelian categories can be found in the *Parmenides* and elsewhere in Plato (*Epitome* 6.10).

⁸⁹ Porph. *Isagoge* vol. 4.1 p. 6 Busse.

a thoroughly appropriate choice as the commentary's subject. Readers of the sort I am postulating would also have benefited from a study of I.15, where Ptolemy sets out the basis of his own divisions of the tetrachord and derives the ratios of their intervals, since its principles have solid roots in the Platonic and Pythagorean past, despite the originality of their application. But it is hard to see how a commentary on Book II could have offered them anything of value. It is remorselessly technical and contains very little to whet philosophical appetites; its subject-matter is alien to Plato and to most Pythagorean theorists; and in the account of the *tonoi* which forms its core, the idiosyncrasies of Ptolemy's position make it useless as a window on the ideas of any other theorist or philosopher. Perhaps it is no coincidence that the commentary breaks off at precisely the point where Ptolemy begins to set out the principles on which his theory of the *tonoi* is based.

8 The translation

Any scholarly translation worth its salt must aim above all at being accurate and faithful to the original text. But it will have little value if its dogged reproduction of the modes of expression, phrase-forms and sentence-structures of the original make its sense unintelligible or its style intolerably awkward. On the other hand these features of a Greek text sometimes significantly affect its meaning, and when they are alien to the language of translation (as is quite often the case with Porphyry) they pose problems to which there is no perfect solution. My attempt at rendering this text into English is a compromise which will certainly not satisfy everyone. I have tried to tie the translation quite closely to Porphyry's modes of expression even when the result is rather unnatural English, so long as this does not obscure the sense (which will not please people who like translations to run smoothly); but when this strategy would present readers with unnecessary challenges I have allowed myself a fair amount of latitude (which will irritate those who insist on faithfulness to the original structures). I would be the first to admit that in following this wavering course between the Devil and the deep blue sea, I have probably sometimes veered too far in one direction or the other.

These are problems that all translators face, but Porphyry's text poses some of its own. Much of it is clearly written, and a few passages – though not many – are quite elegantly polished. But its syntax is often erratic, leaving uncertainties about the relations between clauses, a difficulty that becomes particularly acute in the immense, labyrinthine sentences,

riddled with sub-clauses, with which Porphyry occasionally confronts us. His expressions are sometimes so compressed as to be almost impenetrable, or so abstract that it is hard to tell how they are meant to apply in the context. In some places the most natural reading of his statements produces such incongruous results that we have either to search for an interpretation in which the incongruity can have an intelligible place, or to hunt for rare uses of words or phrases which will allow us to construe the passage differently.

Translators also have to decide whether words that appear repeatedly in the text should always be translated in the same way. In this text it seems wise to do so where the words belong to the technical or quasi-technical vocabulary of harmonics or philosophy, but I think it unnecessary where they do not. Quite often, in fact, it would be positively obstructive, since many common Greek words have a range of meanings which is different from that of any counterpart in English. But a translator who adopts this policy in principle still has tricky choices to make, since the distinction between technical and non-technical expressions is not always clear cut.⁹⁰ Greek philosophers and scientists often co-opted words in common currency for their own special purposes and used them in specialised ways, sometimes in ways that differ from those of adherents to other schools of thought. When such words appear in Porphyry's text, we cannot always tell whether he is using them informally, or whether he is reproducing the specialised terminology of some particular group of his predecessors, and if so which. The problem is exacerbated by the fact that so small a fraction survives of the philosophical texts written between the times of Aristotle and of Porphyry himself.

The translation of terms can be problematic even when they are clearly being used in technical ways, and not only because of anxieties about the English words we choose as their counterparts. Some of them have multiple meanings which no English word can reproduce; the word *logos* is a notorious example, and this text in particular makes very frequent use of two of its specialised meanings, 'reason' and 'ratio'. We cannot always be sure which of them is intended, and sometimes neither seems to fit the context. Wherever either 'reason' or 'ratio' appears in the translation it represents *logos*; in difficult cases I have added footnotes, and where I have translated in neither of these ways I have added '*logos*' in parentheses.

⁹⁰ For a handy statement of what one might mean by calling a term 'technical' see Sedley (1998): 35. But for the reasons I give here (and there are others), the criteria he specifies are not always easy to apply.

Other technical terms are used for the most part in a consistent way, but may shift their application without warning in occasional passages. This creates particularly acute problems in the case of the mathematical term *hyperochē*, which refers to the ‘excess’ of one quantity over another.⁹¹ Since the English word ‘excess’ would not normally be used in the relevant contexts – we do not naturally speak of the ‘excess’ of 12 over 8 or of the ‘excess’ of one length over another – we might expect the locution ‘the difference between X and Y’ to convey the meaning appropriately. In Porphyry’s regular usage, however, as also in Ptolemy’s, this ‘excess’ is not simply the absolute difference between the two quantities (as the difference between 9 and 6 is 3), but the proportion of the smaller quantity by which the greater exceeds it (9 exceeds 6 by half of 6); neglect of this distinction would cause serious misunderstandings. Confusion will also arise, however, if we do not keep a sharp look-out for exceptions, and in a handful of passages the word cannot be assigned its usual Ptolemaic and Porphyrian meaning. In those cases it usually refers to the absolute amount by which the greater exceeds the smaller, and the word ‘difference’ would be a perfectly adequate translation. I have tried to cope with the difficulties the word *hyperochē* presents by translating it consistently as ‘excess’, unnatural though it is in many contexts, and using footnotes to indicate some of the problems it poses and to draw attention to exceptional cases. See further 19.25 with n. 62.

Terms referring to sounds and their attributes have peculiarities of their own. The most general word for a sound in Greek is *psophos*, and I have rendered it consistently as ‘sound’ in the translation. Similarly, in almost all (but not quite all) cases, the word *phthonggos* refers unambiguously to a musical note. Another term that sometimes means ‘note’ is *chordē*, but its literal meaning is ‘string’, and sometimes it is unclear whether it refers to a note or to the string that produces it. More taxing problems are posed by the noun *ēchos*. Sometimes ‘sound’ would seem to be adequate, but often it refers specifically to what I like to call a ‘secondary’ sound, that is, one that is in some way dependent on another. It may for instance be a reverberation or resonance, or the sympathetic vibration of a string when another has been struck. Yet another usage appears in a few passages, where *ēchos* seems to be chosen, rather than *psophos* or *phthonggos*, as a way of focusing attention on a sound’s timbre or pitch; it does not *mean* ‘timbre’

⁹¹ The word has important roles in both Ptolemy and Porphyry, but occurs much more often in the commentary than in the *Harmonics* itself, 99 times in Porphyry and 45 in the parts of Ptolemy’s text which Porphyry discusses. The cognate verb *hyperechein*, similarly, appears 39 times in Porphyry and only 12 times in the relevant chapters of the *Harmonics*.

or 'pitch', but refers to a sound considered as something that possesses these attributes. Clearly no single English word will capture all its uses. Finally, the strict sense of the word *phōnē* is 'voice', and as such it should be used only of the voices of living creatures; but in fact, as Aristotle says, it is commonly used also to refer to any sound with a definite pitch. In these cases 'voice' would be unnatural or misleading, and 'sound' would be rather too general, besides causing potentially damaging confusion with instances of the word *psophos*. There is no perfect translation for any of these terms, with the possible exception of *psophos*. I have always used 'note' for *phthonggos*; for *chordē* I have shifted between 'note' and 'string', depending on the context; I have generally used 'resonance' for *ēchos* and 'voice' for *phōnē*. In passages where it is important to preserve distinctions I have added transliterations, and I have used footnotes to draw attention to problematic or unusual instances.

Many words in the Greek acoustic vocabulary are in origin metaphorical, and this leads to ambiguities which theorists, including Ptolemy and Porphyry, are often prepared to exploit. Thus the basic meaning of the commonest word for 'high pitched', *oxys*, is 'sharp' (as applied to spear-points or needles), and it can also be used to connote intensity or vigour. The theorists readily infer that high-pitched sounds have these qualities too, and draw parallel inferences in the case of the adjective *barys*, which means 'low pitched' in acoustic contexts but literally 'heavy'. So too with many descriptive adjectives, *leptos*, for instance, which means 'light' or 'delicate' in both acoustic and other contexts. Words whose root meanings are connected with tension are often ambiguous, since they are also used with reference to pitch, and the context does not always make clear whether they refer to the pitch of a note or the tension of a string (or indeed the intensity of an impulse of breath). They include *tasis* ('tension' or 'pitch'), *epitasis* and its cognate verb and adjective (referring to increasing tension or raising pitch), *anesis* and its cognates (to do with relaxation of tension or lowering of pitch) and several others.

By itself even the best translation cannot recreate all the peculiarities of Greek acoustic terminology, nor can it always make appropriate distinctions between near-synonyms, or alert readers adequately to the ambiguities of certain terms and the ways in which writers like Porphyry exploit them. Here again I offer some help by adding transliterations or footnotes, but I have tried not to include so many that they become unnecessarily distracting. In general, it should surprise no one if this first modern attempt at a translation is imperfect, as surely it is. I hope that it will at least be adequate enough to stimulate further discussion.

9 The text and the manuscripts

The only modern edition of the text is Düring (1932). The text printed here is not identical with Düring's; quite often I have preferred other readings and emendations. But it should not be mistaken for a fully fledged new edition. I have not undertaken a fresh collation of the manuscripts, and no doubt that is regrettable, since scholars who have examined short sections of the MSS have sometimes questioned the accuracy of Düring's readings; but it is a task I must leave to others more skilled in such work than I am. Düring's text is the foundation of mine, and the changes I have made are based either on other scholars' published comments on it or, occasionally, on conjectures of my own. All such alterations are recorded in the apparatus (which also takes Düring's as its starting-point). Editors should of course avoid emendations, additions and deletions wherever possible, but the MSS tradition of the commentary is very unsatisfactory. As the following summary of Düring's conclusions will show, this is not just because there are frequent disagreements between the MSS and because in uncomfortably many places none of their readings is acceptable.

Düring divided the MSS into four main classes, and later reviewers and commentators have so far published no serious criticisms of his classification.⁹² The principal distinction is between those which derive from Byzantine editions and those which do not. As a general rule (though there are exceptions) the latter are clearly a more reliable guide, since where comparisons between the two groups are possible they suggest that the Byzantine editors had few qualms about introducing textual 'improvements' of their own. The classes are as follows.

1. Class **m** consists of four principal MSS stemming from the same archetype, together with fourteen MSS directly descended from them. Only one of them (V¹⁸⁷, one of the principal four) completes I.4 and goes on to the end of Book I.⁹³ MSS of this class are independent of Byzantine editors. The other principal MSS in this class are **M**, **E**, and **T**. Wherever possible, Düring based his text on the **m** tradition, and especially on **M**.

⁹² But at the end of this section I mention some doubts that have been raised about the validity of the stemma that Düring constructed.

⁹³ 'Für dies Kap. II/4–15 ist V¹⁸⁷ unsere einzige Quelle neben den byzantinischen Redaktionen', Düring (1932): xx.

M = Venetus Marcianus app. cl. VI/10, twelfth century; this is the oldest MS.

E = Vaticanus graecus 186, thirteenth century.

T = Vindobonensis inter phil. gr. 88, fourteenth century.

V¹⁸⁷ = Vaticanus graecus 187, fourteenth century.

2. Class **g** includes over forty MSS derived from the edition of the Byzantine scholar Nicephorus Gregoras (fourteenth century). The MS he used belonged to Class **m**, and in his time it must have continued through to the end of the surviving text,⁹⁴ unlike any of the **m**-class MSS we now possess. Although he seems to have interfered quite substantially with the text it recorded, we have to rely almost entirely on this group for Book II and to some extent for I.4–15. Düring identifies two sub-groups within this class, first **G** and a couple of MSS based on it directly, and then a much larger set of later MSS descended more distantly from them, which are labelled as **p** (I have not listed these later MSS individually below).

The catalogue of Mathiesen (1988) includes three MSS which Düring overlooked: Vaticanus Urbinas 78 (fifteenth century), Upsaliensis gr. 52 (sixteenth century) and Cantabr. gr. 1308 (seventeenth century). If Düring had considered them he would certainly have listed them as members of Class **g**, and probably of sub-group **p**.

G = Vaticanus graecus 198, fourteenth century.

Its immediate descendants are Venetus Marcianus 322 and Monacensis 385, both from the fifteenth century.

3. Class **A** consists of two MSS based on the edition of Isaac Argyros, a student of Nicephorus Gregoras; they are even less reliable than those in Class **g**.

A = Vaticanus graecus 176, fourteenth century. The other MS in this class, Parisinus Supplementarius 449, fifteenth century, was copied from it.

4. Class **h** includes eight MSS, none earlier than the fifteenth century, which offer only paraphrases and have no value as evidence about the wording of the text. They are largely irrelevant to the task of textual reconstruction and are not mentioned in the apparatus.

Thus on Düring's classification of the MSS, only one of those he reckoned the more reliable gives us a text for I.4–15, and for Book II we have only the

⁹⁴ Though perhaps it was not **M** itself, as suggested by Düring (1932): xxii; on this issue see Mountford (1933).

suspect versions derived from the editions of Gregoras and Argyros. Hence there is ample room for uncertainty about the accuracy of the readings in the later parts of the text. While that remains true, however, I should record here that Massimo Raffa has found reasons for questioning the validity of some aspects of Düring's stemma.⁹⁵ Some of his reasons are of a general sort; other doubts arise from the relations he has noticed between certain MSS readings in particular passages. Since his research into the issues is not complete at the time of writing, and his arguments and conclusions have not yet been published, I shall not go into details; interested readers must await his forthcoming edition and translation.

10 The lemmata

Porphry usually introduces the sections of his commentary by quoting the passage of Ptolemy he is about to consider. Some of the MSS reproduce the whole of the relevant parts of Ptolemy's text (or of most of them) in these lemmata; others identify the longer passages by quoting only their beginnings and ends, as for instance at 39.24: τῶν δὲ ψόφων ἕως τοῦ πρὸς τὴν αἴσθησιν ('from "In the case of sounds" as far as "to the senses"'). Whereas Düring printed only the abbreviated versions of the lemmata, I have chosen to reproduce and translate the passages in full, so that readers can have them immediately under their eyes. The text of Ptolemy which I have used for this purpose is nearly identical with that of Düring (1930); I have not re-edited it, and have introduced very few changes.⁹⁶ The translation is taken from Barker (1989), with minor modifications.

Taken together, the lemmata for I.1–8 and II.1–3 include, with the exception of one passage,⁹⁷ the whole of the relevant chapters of Ptolemy, but there are gaps in the later chapters of both books. Parts of the text of *Harm.* I.9–10 and of II.4–7 are missing from the lemmata; I.11 and I.12 simply quote the first phrases of the chapters at the outset and then add 'and so on', though the intended extent of these lemmata becomes clear from Porphyry's treatments of them; and I.13–14 include no lemmata at all. It is unlikely that these omissions are due merely to a copyist's idleness. Porphyry provides *verbatim* quotations or close paraphrases of the missing parts of Ptolemy's I.9–10, nearly the whole of I.11–12 and much of I.13–14 within the text of the commentary itself, and he probably thought it unnecessary to reproduce the material twice (though in II.4–7 his paraphrases of the missing passages are looser and less complete). The MSS also preserve no

⁹⁵ Personal communication, for which I am very grateful to him.

⁹⁶ I include only a very limited apparatus to the lemmata. For further details, see Düring (1930).

⁹⁷ *Harm.* 12.8–27, at the end of I.5. I insert the passage as a bracketed lemma at 98.17; see n. 422 ad loc.

commentary and no lemmata for the last paragraph of Ptolemy's I.15 and omit the whole of I.16.

Here I have adopted the following policies. (a) Where lemmata are provided in these chapters, I have printed them in full, as elsewhere. (b) In I.13–14 the mixture of paraphrase and comment becomes a little confusing, and I have printed, in brackets, the whole of Ptolemy's corresponding chapter at the beginning of each. (c) In the parts of I.9–12 and I.15 where lemmata are replaced by quotations or close paraphrases in Porphyry's own text, it seemed to me unnecessary to print the passages also as lemmata. I have identified these cases in footnotes to the translation, where I also indicate the differences between Porphyry's wording and Ptolemy's, and pick out from Ptolemy's text the remarks that Porphyry has added. (d) I have added the text of the last paragraph of Ptolemy's I.15 and the whole of his I.16 as bracketed lemmata. The latter in particular is an essential preliminary to II.1 (see Section 3 above). (e) In II.4–7, in which the paraphrases are inadequate representations of Ptolemy's text, I have again supplied the missing passages as bracketed lemmata. Throughout the translation I have kept footnotes on the lemmata to a bare minimum. For fuller annotations see Barker (1989): 275–391, Solomon (1999), Raffa (2002).

II Forms of reference

- (i) Except where the context makes it clear that some other work is referred to, all references given without the name of an author or a work are to Porphyry's commentary.
- (ii) All references to *Harm.* without an author's name are to Ptolemy's *Harmonics*.
- (iii) References to Aristoxenus *Elementa harmonica* are identified by reference to the page and line numbers of Meibom's edition (1652), which appear in all modern editions. The point needs to be made, since some recent scholars have taken to using the page and line numbers of the edition of Da Rios (1954) instead, a practice that strikes me as unhelpful. The edition of Macran (1902), for instance, is still in use, and no one using it will be able to locate the passages indicated by reference to the 1954 publication.
- (iv) All references to works by other authors are given in the normal way.
- (v) Page and line numbers printed with the Greek text are those of Düring's edition. In the translation his page numbers appear in the form '3D', '4D', and so on; vertical strokes mark the beginning of every fifth line.

*Πορφυρίου εἰς τὰ ἀρμονικὰ Πτολεμαίου
ὑπόμνημα*

Πορφυρίου εἰς τὰ ἁρμονικά Πτολεμαίου
 υπόμνημα

- (3) Πολλῶν αἰρέσεων οὐσῶν ἐν μουσικῇ περὶ τοῦ ἡρμοσμένου, ὧς Εὐδόξιε, δύο πρωτεύειν ἂν τις ὑπολάβοι, τὴν τε Πυθαγόρειον καὶ τὴν Ἀριστοξένειον, ὧν καὶ τὰ δόγματα εἰς ἔτι καὶ νῦν σωζόμενα φαίνεται. ὅτι μὲν γὰρ ἐγένοντο πλείους αἱ μὲν πρὸ τοῦ Ἀριστοξένου, οἷα ἡ Ἐπιγόνειος
- (5) καὶ Δαμώνιος καὶ Ἐρατόκλειος Ἀγηνόριός τε καὶ τινες ἄλλαι, ὧν καὶ αὐτὸς μνημονεύει, αἱ δὲ μετ' αὐτόν, ὥς ἄλλοι ἀνέγραψαν, οἷα ἡ Ἀρχεστράτειος καὶ ἡ Ἀγώνιος καὶ ἡ Φιλίσκιος καὶ ἡ Ἑρμίππιος καὶ εἴ τινες ἄλλαι, ἔχοιμεν ἂν λέγειν. ὅτι δὲ τὸ πρωτεῖον ἐν ταῖς εἰρημέναις δύο εὐρίσκεται, δηλοῖ μὲν καὶ ἡ τῶν δοκούντων αὐτοῖς μάθησις, οὐχ
- (10) ἥκιστα δὲ καὶ τὸ τὰς μὲν ἄχρι ὀνόματος μένειν διὰ τὸ ἐπιπόλαιον ἀφανι-

In titulo προσίμιον add. p

PORPHYRY'S COMMENTARY ON PTOLEMY'S *HARMONICS*

BOOK I

There are many schools of thought in musical science, Eudoxius, on the subject of attunement,¹ but there are two that one might reckon pre-eminent, those of the Pythagoreans and the Aristoxenians, whose actual doctrines have been preserved, as we can see, right up to the present day. We could say that there were more,² some earlier than Aristoxenus, such as those of Epigonus, | Damon, Eratocles, Agenor and certain others – he mentions these himself – and some later, which other people have put on record, such as those of Arcestratus, Agon, Philiscus, Hermippus and perhaps others.³ But the fact that two of them turn out to lead the field becomes clear both from an examination of their opinions, and not | least from the fact that while the others have disappeared because of their superficiality and survive only as names,⁴ these two have been preserved [3D]

¹ The identity of Eudoxius is unknown. A *hairesis* is a 'school of thought' rather than simply a 'school'; members of a *hairesis* subscribed to the same fundamental doctrines or principles, but the word carries no implication that they belonged to a single organised institution. See Karamanolis (2006): 249–52. 'Attunement' translates *to hērmosmenon*, literally 'that which has been attuned'. The regular term for 'attunement' in its more abstract sense is *harmonia*, and writers sometimes point out that the two expressions are not strictly synonymous (Porphyry does so at 12.2–5 below). In translating *to hērmosmenon* I have allowed myself some flexibility, however, sometimes preferring 'attunement' to the more cumbersome phrase when it will not be significantly misleading.

² Porphyry seems to be raising a possible objection to his treatment of the Pythagorean and Aristoxenian *haireseis* as the only significant schools of thought in harmonics; he answers it in the next sentence.

³ Of the four pre-Aristoxenian theorists mentioned, Epigonus, Eratocles and Agenor are mentioned in Aristox. *El. harm.*, at 3.22, 5.9–7.1, 37.35–38.1. In view of Damon's reputation it is likely that Aristoxenus also referred to him from time to time in his writings, but no such passages have survived (this is not, of course, the Damon who plays a heroic role in Aristox. fr. 31 Wehrli). Very little is known of the four who are said to have come later than Aristoxenus. On Arcestratus see 26.26–27.16 below. Agon is completely unknown, and no one named Philiscus or Hermippus is said elsewhere to have written on music. Just possibly this Philiscus is the Aeginetan student of Diogenes the Cynic who is mentioned several times by Diogenes Laertius (VI.73, 75, 80, 84); he is said to have taught Alexander and to have written dialogues (*Suda* Φ 359); according to some authorities he also wrote tragedies (Diog. Laert. VI.73, 80). But his dates are probably too early. Other possibilities include Philiscus of Corcyra, a tragedian who was priest of Dionysus in the reign of Ptolemy Philadelphus (*Suda* Φ 358, Ath. 198b), and Philiscus of Thessaly (early third century AD), who was a member of Julia Domna's circle in Rome, and subsequently held the chair in rhetoric in Athens (cf. Philostratus *Vit. soph.* 30). The most famous Hermippus is the third-century scholar who wrote biographies of philosophers and other intellectuals, and is repeatedly cited by Diogenes Laertius, Plutarch and others, but none of the allusions connects him with musical thought; nor is there much to commend the hypothesis that Porphyry is referring to the first-century aulete of that name, known only from an anecdote at Ath. 615b.

⁴ For 'superficiality' as the sense of τὸ ἐπιπόλαιον, see Alex. Aphr. *In Metaph.* 26.23, *In Meteor.* 79.29. I would like to record my gratitude to the late Professor Bob Sharples for this suggestion and the references.

σθείσας, τὰς δὲ καὶ ἐν ἀμουσίᾳ πολλῇ τῶν μεταγενεστέρων εἰ καὶ μὴ ἐν ἐπιστήμῃς ἀλλ' ἀναγεγραμμένας διασώζεσθαι.

- Ἰκανῶς δ' αὐτὰς πρὸ Πτολεμαίου μὲν Διδύμου τοῦ μουσικοῦ διακρί-
ναντος ἐν προηγουμένῳ περὶ αὐτῶν συγγράμματι, Πτολεμαίου δὲ καὶ
(15) ἐξετάσαντος ἐν τοῖς Ἀρμονικοῖς καὶ τὴν ἀπ' ἀμφοῖν ὠφέλειαν ἐπιδεί-
ξαντος τὴν τε δοκοῦσαν πρὸς ἀλλήλας μάχην συμβιβάσαντος, ἔκρινα τῶν
Πτολεμαίου Ἀρμονικῶν ἐξήγησιν καταβάλλεσθαι εἰδῶς
μὲν μηδένα ἄχρι καὶ νῦν, ὅσον κάμει γινώσκειν, τουτὶ πεποιηκότα, ὁρῶν
δὲ μὴ εὐσύνοπτον οὔσαν τὴν ἀνάγνωσιν τοῖς μὴ τὰς αἰρέσεις ἀκριβῶς
- (4) ἀνειληφόσιν ἔν τε τοῖς μαθήμασιν εἰσηγμένοις, ὧν ἐν πολλῇ ἔξει γεγωνῶς
οὗτος ἐμπέπληκε τὰ συγγράμματα, τὴν μὲν πρόφασιν τῆς χρήσεως λαβὼν
παρὰ τῶν πρεσβυτέρων—οὐχ ἦττον γὰρ τῶν Πυθαγορείων καὶ οἱ Ἀρι-
στοξένειοι ταῖς διὰ τῶν ἀριθμῶν χρῶνται ἀποδείξεσιν—αὐτὸς δ' ἐκ
(5) τῆς ἐν τοῖς μαθήμασιν ἐντρεχείας κατακόρως τούτοις χρησάμενος, ἅτε
καὶ τοῦ λογικοῦ κριτηρίου αὐτὸν ἐπὶ τοὺς ἀριθμούς καὶ τὸ ἐντεῦθεν ἀδιά-
πτωτον εἰς τὰ μέτρα τῶν τῇ αἰσθήσει ἀλόγως φαινομένων παραπέμ-
ποντος.
- Ἐνῆγε δέ με πρὸς τὴν ἐξήγησιν καὶ τὸ μόνον ἢ μάλιστα τὸν Πτολε-
(10) μαῖον τὴν περὶ τὸ ἡρμωσμένον θεωρίαν τελεῶσαι οὐχ οὕτω τῇ προσθέσει—
ὀλίγα γὰρ ἔστι παντάπασιν, ἃ τοῖς παλαιοῖς προσεξεῦρεν—ὥς τῇ κρίσει
τῶν παρ' αὐτοῖς θεωρημάτων. κριτικὸς γὰρ καὶ ἐλεγκτικὸς τῶν ὑγιῶν,
εἰ καὶ τις ἄλλος, ἐν τῇ πραγματείᾳ ταύτῃ γέγονεν ἐκ καθαρᾶς μὲν τῆς
θεωρίας καὶ ἀποκρίνας πᾶν τὸ φιλονείκως πρὸς τε τὰ κριτήρια καὶ τὰ
(15) κρινόμενα ὑπ' αὐτῶν εἰρημένον, ἐπιδείξας δὲ τὰ καλῶς εἰρημένα σύμ-

17 καταβαλέσθαι T

9 τῶν Πτολεμαίων M

10 προσθέσει Wifstrand προθέσει codd.

11 ἃ τοῖς] αὐτοῖς M ὥς] ἐν G

even in the thoroughly uncultured environment of later generations, at least as written texts, even if they are no longer studied.⁵

Before Ptolemy, Didymus, the writer on music, described the distinctions between them very adequately in his pioneering⁶ treatise about them, and Ptolemy | examined them in his *Harmonics*, making clear what is useful in each of them and reconciling the apparent conflict between them.⁷ I have therefore decided to attempt an explication of Ptolemy's *Harmonics*, since – so far as my own knowledge is concerned – I know of no one up to this time who has done it, and also because I recognise that reading it is no easy task for people who have not made a detailed study of these schools of thought or been trained in the mathematical sciences, in which Ptolemy was a great expert and with which he filled his writings. In this he took the older writers' procedure as the basis of his own (for the Aristoxenians, no less than the Pythagoreans, used demonstrations involving numbers); | but because of his great skill in the mathematical sciences he himself drew on them deeply and extensively, since the criterion of reason directed him to numbers and to the security from error they provide when we seek to measure things that appear non-rationally to perception.

[4D]

I was led to undertake this exposition also by the fact that only Ptolemy, or he above all, | brought the science of attunement to perfection, not so much by what he added,⁸ since there are very few facts that he discovered in addition to those set out by earlier writers, as by his critical assessment of their theories. For the lucidity of his intellectual vision made him, if anyone, capable of discriminating sound theses in this field of enquiry and putting them to the test; and he rejected in their entirety his predecessors' quarrelsome polemics about the criteria of judgement and the | matters

⁵ More literally, 'even if they are no longer among the sciences' or '...among the branches of knowledge'.

⁶ Or perhaps just 'outstanding', 'very distinguished'. Almost everything we know about this Didymus (probably active around the middle of the first century AD) comes from Ptolemy (*Harm.* II.13–14) and Porphyry (5.11–14, 25.3–28.34, 107.15 below).

⁷ This remark reflects the project of 'reconciling' the doctrines of earlier thinkers who were reckoned authoritative (particularly Plato and Aristotle), which was widespread among philosophers in Ptolemy's time, and especially characteristic of Porphyry and the Neoplatonists who followed him (see Introduction pp. 25–7). But it is misleading as a comment on Ptolemy himself. He does indeed take over a good deal from the Pythagoreans, while criticising other aspects of their approach; but he attacks the Aristoxenians whenever he mentions them, and nowhere admits to finding anything 'useful' in their theories. Not even the two principles adopted 'on the basis of agreed perception' at *Harm.* 33.22–7, despite their broadly Aristoxenian flavour, belong strictly to that school of thought; the first is repeatedly breached by Aristoxenus himself and the second is common to harmonic theorists of all traditions.

⁸ The MSS reading *prothesei*, printed in Düring's edition, makes reasonable sense: 'not so much by his factual statements...' But Wifstrand's small emendation, *prosthesi*, giving the sense conveyed in my translation, fits the context better and is probably correct.

- φωνα τοῖς τε πράγμασι καὶ τοῖς τούτων κριτηρίοις. τὴν δ' ἐν τούτοις
κατόρθωσιν οὐ μόνον αὐτῶν τὸ εὐπερινόητον τῆς φύσεως τῆς οἰκείας
παρέσχε· σχεδὸν γὰρ ἐν πᾶσιν, οἷς συνέγραψε, τοιοῦτος οὐδὲ τὸ γεγυ-
(20) μνάσθαι καὶ πολλὴν ξιν ἐν τοῖς μαθήμασιν ἔχειν, ἀλλὰ καὶ τὸ ἐκ φιλοσο-
φίας μάλιστα τῆς τῶν παλαιῶν ὠρμῆσθαι, ἀφ' ἧς καὶ οἱ Πυθαγόρειοι
καὶ οἱ Ἀριστοξένειοι τὸ ἐπιστημονικὸν ἐν ταῖς θεωρίαις συνηύξησαν.

- Προηρημένοι τοίνυν τὰ Ἀρμονικὰ τοῦ Πτολεμαίου
ἐξηγεῖσθαι ἐπεργασόμεθα μὲν τὰ πλεῖστα μετὰ τοῦ στοχάζεσθαι τῆς
συμμετρίας. εἰ δέ τισι τῶν παρὰ τοῖς πρὸ ἡμῶν εἰς τὴν ἐξήγησιν κατα-
(25) χρησαίμεθα, οὐχ ὑποβολὴν ἐγκλητέον ἡμῖν τὸ τοιοῦτον, φειδῶ δὲ τοῦ
χρόνου, ἐν οἷς ἔνεστι χρήσασθαι τοῖς παρασκευασμένοις πρὸς τὸ χρήσι-
μον. πάνυ γάρ μοι αἰεὶ καλῶς ἔχειν ἔδοξε τὸ κοινὸν εἶναι τὸν Ἑρμῆν
λέγεσθαι, ὥς κοινωνίαν τῶν λόγων πᾶσιν ὀφειλόντων, δεινὴν τε φιλοτιμίαν
κατέγων τῶν παρατρέπειν ἢ παραφράζειν ἐθελόντων τὰ ἄλλοις εἰρημένα
(5) ὑπὲρ τοῦ δοκεῖν ἴδια λέγειν. τοῦτο γὰρ οὐκ ἦν τὴν προνομίαν διδόντων
τοῖς πράγμασιν, ὣν εἵνεκα καὶ τοῦ λόγου ἐδεήθημεν, διὰ δὲ τὸ φράζειν
μᾶλλον καὶ τοῖς πράγμασι καταχρωμένων. ἐγὼ δὲ τοσούτου δέω παραι-
τεῖσθαι χρῆσθαι τοῖς ὑγιῶς τισιν εἰρημένοις, ὥστε καὶ εὐξαίμην ἂν πάν-
(5) τας τὰ αὐτὰ λέγειν περὶ τῶν αὐτῶν καὶ ὥς ὁ Σωκράτης ἔφασκε διὰ
τῶν αὐτῶν, καὶ οὐκ ἂν ἦν ἀμφίλεκτος περὶ τῶν πραγμάτων τοῖς ἀν-
θρώποις ἔρις. οὐ παρήσω δὲ πολλαχοῦ τὸ ἐπ' ὀνόματος μηνύειν, ὣν ἂν
ταῖς ἀποδείξεσι χρήσωμαι, ἐπεὶ καὶ αὐτὸν τοῦτον, δι' ἐξηγούμεθα, τὰ
μὲν πλεῖστα, εἰ καὶ μὴ σχεδὸν πάντα, εἰληφότα παρὰ τῶν πρεσβυτέρων
(10) εὐρίσκομεν καὶ ὅπου μὲν ἐνδεικνύμενον παρ' ὧν εἴληφε τὰς ἀποδείξεις,

21 ἐν ταῖς om. M 24 τισί] τι g καταχρησάμεθα g 25 ὑπερβολὴν G 27 ἔχειν om. Mg
28 κοινωνίαν Alexanderson κοινωνία codd.

1 ὑπὲρ Wifstrand ὑπό codd. 2 τό] τοῦ M 3 μᾶλλον] ἄλλον M 4 καὶ Düring κἂν codd.
5 ὥς om. Mg ὁ om. ET δι' αὐτῶν M 6 ἀμφίλεκτος Olson et Sluiter ἀναμφίλεκτος codd.
9 εἰ om. MT

upon which they judge, bringing out instead what had been well said, and showing that it is in concord with the facts and with the criteria by which they should be judged. What enabled him to put these matters right was not just his careful consideration of these things' proper nature; for in virtually everything he wrote he shows himself not only to have been trained in the mathematical sciences and to have a great aptitude for them, but also to have taken as his fundamental starting-point the philosophy | of the ancient writers, through which the Pythagoreans and Aristoxenians too enhanced the scientific character of their enquiries.

Having chosen, then, to expound the *Harmonics* of Ptolemy, I shall aim, for the most part, at due proportion in my discussion of it.⁹ If in my exposition I make use of some things written by my predecessors, | this should not be held against me as plagiarism, but treated as a way of saving time in connection with matters where one can put to good use things that are already available. For the saying 'Shares in good luck!'¹⁰ has always struck me as a good one, since what has been said should belong to everyone, and I disapprove of those who attempt to alter or paraphrase other people's statements so as to seem to be saying something original. That is not a mark of people who privilege the matters on whose account the discussion was needed, but is done merely for the sake of talking and is typical of people who mistreat the facts. I am so far from apologising for making use of things that have been well said by others that I could wish that | everyone said the same things about the same things, and in the same words, as Socrates put it;¹¹ people would not then be embroiled in disputatious strife¹² about the facts. In many cases I shall take care to name those whose arguments I use, since I find that the very writer we are expounding has taken most, if not virtually all, of what he says from earlier sources, | and that in some places he indicates from whom he has taken

[5D]

⁹ What Porphyry means by this is unclear. His comments are certainly not 'proportionate' in length to the passages he discusses. Perhaps he means that he devotes more attention to issues he considers more important (cf. Introduction p. 4), but he does not specify the criteria by which he judges their importance.

¹⁰ Literally, 'Hermes is common', i.e. 'common property', where Hermes stands for good luck. Travellers said it when one of them found something on the road, claiming common rights in any such discovery. See Cornutus *De nat. deorum* 24.7, Diogenianus *Paroem.* 5.38, and cf. Theophrastus *Char.* 30.9; cf. also e.g. Aristotle *Rhet.* 1401a21, Menander *Epitr.* 284, 317.

¹¹ The allusion is probably to Plato *Gorg.* 490e; cf. also 482a, 491b, 527d, *Symp.* 221e and *Soph.* 230b, *Tim.* 40a, *Laws* 817c (though in the last three the speaker is not Socrates), Xen. *Mem.* 4.4.6. My thanks to Stefan Schorn, Douglas Cairns, Stephen Halliwell, Eran Almagor and several other correspondents for their help with these references.

¹² The text in the MSS. ἀναμφιλεκτός . . . ἐρις, 'un-disputatious strife' can hardly be right. Porphyry is echoing Euripides' phrase ἀμφιλεκτός ἐρις, at *Phoen.* 500. For details on the emendation see Olson and Sluiter (1996).

- ὅπου δὲ σιωπῇ παρερχόμενον. τὸ γοῦν Διδύμου Περί διαφο-
 ρᾶς τῆς Πυθαγορείου μουσικῆς πρὸς τὴν Ἀρι-
 στοξένειον κατὰ πολλοὺς τρόπους μεταγράφων οὐδαμοῦ τοῦτο
 (15) μεμήνυκεν, καὶ παρ' ἄλλων ἄλλα μετατιθεῖς παρῆλθε σιγῇ, ὥς ἐπιδείξο-
 μεν. καὶ οὐκ ἂν τις αὐτὸν ἐπὶ τοῦτο καταμέμψαιτο τοῖς καλῶς εἰρημέ-
 νοις ὥς κοινοῖς οὖσι πάντων κεχρημένων.

Ἄ μὲν οὖν ἀναγκαῖον ἦν μοι προειπεῖν, ἔστι ταῦτα. παρεῖς δέ σοι
 κρίνειν τὴν ἐξήγησιν ἐντεῦθεν ἄρχομαι τοῦ προκειμένου.

α'

[3] Ἀρμονικὴ ἐστὶ δύναμις καταληπτικὴ τῶν ἐν τοῖς ψόφοις περὶ τὸ
 ὀξύ καὶ τὸ βαρὺ διαφορῶν.

- (21) Τὴν μουσικὴν σύμπασαν διαιρεῖν εἰώθασιν εἰς τε τὴν ἀρμονικὴν καλου-
 μένην πραγματείαν, εἰς τε τὴν ῥυθμικὴν καὶ τὴν μετρικὴν, εἰς τε τὴν
 ὀργανικὴν καὶ τὴν ἰδίως κατ' ἐξοχὴν ποιητικὴν καλουμένην καὶ τὴν
 ταύτης ὑποκριτικὴν. μουσικοὶ γὰρ λέγονται πάντες οἱ περὶ ταῦτα τεχνί-
 (25) ται. τὰ μὲν οὖν ἄλλα μέρη τῆς μουσικῆς τὰ νῦν παρείσθω, περὶ δὲ τῆς
 ἀρμονικῆς σκεπτέον, ἥ τάξει μὲν ὑπάρχει πρώτη, δύναμιν δὲ στοιχειώδη

11 γοῦν] οὖν T 16 κεχρημένον MT 19 ante lemma add. ἐντεῦθεν ἢ τοῦ ῥητοῦ ἐξήγησις κεφ.
 α' περὶ τῶν ἐν ἀρμονικῇ κριτηρίων T ἐντεῦθεν ἄρχεται ἢ τοῦ ῥητοῦ ἐξήγησις p

his demonstrations, but elsewhere passes over them in silence. He borrows in many respects, at any rate, from Didymus' work *On the differences between Pythagorean and Aristoxenian musical science*, without mentioning it anywhere, and has silently appropriated other things from others, as we shall show.¹³ | But one should not hold this against him, since everyone uses what has been well said as property held in common.

So much, then, for necessary preliminaries. At this point I shall set out on the project I have proposed, leaving you to form a judgement on my exposition.

Chapter 1¹⁴

Harmonics is the power¹⁵ of apprehending | the differences between sounds in respect of high pitch and low. Ptol. *Harm.* 3.1–2

People have generally divided musical science into the following branches: the enterprise called 'harmonics', rhythemics and metrics, the study of instruments, the study of what is called 'composition' in the special sense applicable here, and the study of its performance; for all artists in these fields are called 'musicians'.¹⁶ | Let us put the other parts of musical science aside for the present and consider harmonics, which is first in rank and

¹³ The statement that virtually everything in Ptolemy is borrowed from his predecessors, and that much of it came from Didymus, is certainly exaggerated, though it becomes clear from Ptolemy's and Porphyry's citations that Didymus' treatise, now lost, was a very substantial piece of work which itself incorporated quite detailed accounts of theories found in earlier writings. It is true that Ptolemy rarely mentions other writers by name; and though he names and discusses Didymus in *Harm.* II. 13–14, he acknowledges no debts to any individual theorist. The most he does is to recognise certain agreements with anonymous 'Pythagoreans' and qualified agreement on one issue with Archytas. On what we know of Didymus see Barker (1989): 230, 242–4 and (1994), Hagel (2009): 187–94, Creese (2010): 288–92.

¹⁴ The numbered chapters are those of Ptolemy's text, into which Porphyry also divides his own.

¹⁵ I am aware of Jon Solomon's strictures (Solomon (1999): 2 n. 3) on the practice of translating *dynamis* as 'power' in this context; his preferred translation is 'function'. I continue to render it as 'power' in translating both Ptolemy and Porphyry, despite Solomon's comments and despite its awkwardness in English. He and I would agree that *harmonikē*, 'harmonics', does not refer here to a body of knowledge contained in books; it is knowledge that exists only in living minds. Porphyry's remarks at the end of this section (6.33–7.5) show that he is thinking of it as constituting the power or capacity of a suitably trained human mind to 'apprehend', as Ptolemy puts it, the distinctions and relations between the elements of musically organised sound. This accurately reflects Ptolemy's own usage, as is brought out most clearly in *Harm.* III.3, where 'the harmonic *dynamis*' is identified with 'harmonic reason' (*logos*), the capacity that equips us to understand and construct mathematically correct melodic systems of audible sounds.

¹⁶ 'Musicians' translates *mousikoi*. In other contexts the adjective is often used to describe people as 'musical' or simply 'cultured' in a general sense, without implying special expertise or practical skill; but here they are identified as *technitai* ('artists'), a term reserved, in relevant contexts, for professionals in the performing arts, and 'musician' seems a more appropriate rendering.

κέκτηται, θεωρητικὴν τῶν πρώτων οὐσαν ἐν μουσικῇ. ταῦτα δ' ἐστὶ

- (6) φθόγγοι τε καὶ διαστήματα καὶ τὰ ἐκ τούτων συστήματα τὰ τε τούτοις ἐπιφαινόμενα γένη καὶ πάντα, ὅσα συνεργεῖ πρὸς τὴν τῶν τελείων λεγομένων συστημάτων ἐπίγνωσιν.
- Ὅρίζονται δ' αὐτὴν οἱ μὲν ἐπιστήμην θεωρητικὴν τῆς τοῦ ἡρμοσμένου φύσεως, οἱ δ' ἕξιν θεωρητικὴν τοῦ διαστηματικοῦ μέλους καὶ τῶν τούτῳ συμβαινόντων, ὅπερ ἰδίως ἡρμοσμένον προσαγορεύεται, μελωδούμενον ἐπὶ τῶν τελείων συστημάτων, ἃ δὴ τρόπους τε καὶ τόνους καλεῖν εἰώθαμεν. ὁ δὲ Πτολεμαῖος δύναμιν αὐτὴν ἀποδέδωκε καταληπτικὴν τῶν ἐν τοῖς ψόφοις περὶ τὸ ὀξύ καὶ τὸ βαρὺ διαφορῶν. εἰς ταῦτό δὲ συντείνειν δοκοῦσιν οἱ ὅροι. ἥ τε γὰρ καταληπτικὴ δύναμις θεωρητικὴ τίς ἐστιν ἕξις, ἣ αὐτὴ δὲ καὶ ἐπιστήμη κατὰ τὴν παλαιὰν χρῆσιν τοῦ ὀνόματος τῆς ἐπιστήμης, ἣν κοινῶς κατὰ πασῶν τῶν θεωρητικῶν προσηγόρευον ἕξεων. τό τε τῶν ἐν τοῖς ψόφοις περὶ τὸ ὀξύ καὶ τὸ βαρὺ διαφορῶν οὐδὲν διαφέρει λέγειν ἥ τῆς τοῦ ἡρμοσμένου φύσεως ἥ τοῦ διαστηματικοῦ μέλους. ἐκ γὰρ τῶν τοῦ ὀξέος καὶ τῶν τοῦ βαρέος διαφορῶν συνίσταται τὸ ἡρμοσμένον, ὃ δὴ καὶ διαστηματικὸν κέκληται μέλος. οὕτω μὲν οὖν ἐξηγουμένοις εἰς τὸ αὐτὸ συντείνειν δόξουσιν οἱ ὅροι. μήποτε δ' ἀκριβέστερος ὁ δύναμιν καταληπτικὴν ἀποδιδούς τῶν ἐν τοῖς ψόφοις περὶ τὸ ὀξύ καὶ τὸ βαρὺ διαφορῶν, ὅτι καὶ περιληπτικώτερος πάντων τῶν ὑπὸ τὴν ἀρμονικὴν θεωρίαν πιπτόντων. οὐ γὰρ μόνον θεωρητικὴ τῆς τοῦ ἡρμοσμένου φύσεως ἢ ἀρμονικὴ, ἀλλὰ τοῦτο μὲν προη-
- (10) νειν δοκοῦσιν οἱ ὅροι. ἥ τε γὰρ καταληπτικὴ δύναμις θεωρητικὴ τίς ἐστιν ἕξις, ἣ αὐτὴ δὲ καὶ ἐπιστήμη κατὰ τὴν παλαιὰν χρῆσιν τοῦ ὀνόματος τῆς ἐπιστήμης, ἣν κοινῶς κατὰ πασῶν τῶν θεωρητικῶν προσηγόρευον ἕξεων. τό τε τῶν ἐν τοῖς ψόφοις περὶ τὸ ὀξύ καὶ τὸ βαρὺ διαφορῶν οὐδὲν διαφέρει λέγειν ἥ τῆς τοῦ ἡρμοσμένου φύσεως ἥ τοῦ διαστηματικοῦ μέλους. ἐκ γὰρ τῶν τοῦ ὀξέος καὶ τῶν τοῦ βαρέος διαφορῶν συνίσταται τὸ ἡρμοσμένον, ὃ δὴ καὶ διαστηματικὸν κέκληται μέλος. οὕτω μὲν οὖν ἐξηγουμένοις εἰς τὸ αὐτὸ συντείνειν δόξουσιν οἱ ὅροι. μήποτε δ' ἀκριβέστερος ὁ δύναμιν καταληπτικὴν ἀποδιδούς τῶν ἐν τοῖς ψόφοις περὶ τὸ ὀξύ καὶ τὸ βαρὺ διαφορῶν, ὅτι καὶ περιληπτικώτερος πάντων τῶν ὑπὸ τὴν ἀρμονικὴν θεωρίαν πιπτόντων. οὐ γὰρ μόνον θεωρητικὴ τῆς τοῦ ἡρμοσμένου φύσεως ἢ ἀρμονικὴ, ἀλλὰ τοῦτο μὲν προη-
- (15) οὕτω μὲν οὖν ἐξηγουμένοις εἰς τὸ αὐτὸ συντείνειν δόξουσιν οἱ ὅροι. μήποτε δ' ἀκριβέστερος ὁ δύναμιν καταληπτικὴν ἀποδιδούς τῶν ἐν τοῖς ψόφοις περὶ τὸ ὀξύ καὶ τὸ βαρὺ διαφορῶν, ὅτι καὶ περιληπτικώτερος πάντων τῶν ὑπὸ τὴν ἀρμονικὴν θεωρίαν πιπτόντων. οὐ γὰρ μόνον θεωρητικὴ τῆς τοῦ ἡρμοσμένου φύσεως ἢ ἀρμονικὴ, ἀλλὰ τοῦτο μὲν προη-
- (20) πάντων τῶν ὑπὸ τὴν ἀρμονικὴν θεωρίαν πιπτόντων. οὐ γὰρ μόνον θεωρητικὴ τῆς τοῦ ἡρμοσμένου φύσεως ἢ ἀρμονικὴ, ἀλλὰ τοῦτο μὲν προη-

2 συνεργεῖ] συντελεῖ G

14 ἡ^{prim} Düring εἰ codd.

21 τῆς – ἀρμονικὴ om. Mg

7 τόνους scripsi τόπους codd.

15 τῶν om. MG

τοῦ^{sec} in τῶν mut. m. pr. M

12 προσηγόρευον] προσηγορίαν T

16 μέλος] μέρος M

possesses the fundamental power of discerning the things that are primary in music.¹⁷ These are notes and intervals, the systems made out of them and the genera that present themselves in the systems, and everything that contributes to an understanding of what are called the 'perfect systems'.¹⁸ [6D]

Some people define it as 'the knowledge that discerns the nature of that which is attuned', | others as 'the skill of discernment directed to intervallic melody and its attributes'¹⁹ – the melody, that is, which is specifically designated as 'attuned', and which is instantiated melodically in the perfect systems, which we usually call *tropoi* or *tonoi*.²⁰ Ptolemy represents it, however, as 'the power of apprehending the differences between sounds in respect of high pitch and low'. But the definitions seem | to apply to the same thing. For a power of apprehension is a kind of skill of discernment, and it is also 'knowledge' (*epistēmē*) according to the ancient usage of that term, which was the name they gave jointly to all skills of discernment. Further, to say 'the differences between sounds in respect of high pitch and low' is no different from saying 'the nature of that which is attuned' or 'intervallic | melody'. For it is from differences in respect of high pitch and low that what is attuned is put together, and it is also designated as 'intervallic melody'.

When we expound them in this way, then, the definitions will appear to apply to the same thing; but perhaps the more accurate is the one representing it as the power to apprehend the differences between sounds in respect of high pitch and low, since it is more capable of embracing | all the things that fall within the province of harmonics. For harmonics does not discern only the nature of that which is attuned; it does that primarily,

¹⁷ The second half of this sentence (from 'which is first') is quoted from Aristox. *El. harm.* 1.16–18, and probably preserves a better version of the text than the one transmitted in the Aristoxenus MSS.

¹⁸ On systems (*systemata*) and 'perfect' or 'complete' systems (*teleia systemata*) see especially 162.31–164.2.

¹⁹ Both these definitions are probably taken from Aristoxenian sources, though they cannot be confidently identified.

²⁰ The reading *topoi* ('places' or 'ranges') instead of *tonoi* in Düring's edition must, I think, be an error. The variously transposed instances of the perfect systems are most often called *tonoi* (roughly, 'keys'), but writers of the Roman period quite often give them the name *tropoi* instead (in Arist. Quint. *De mus.* 1.11, for instance, the two terms are used interchangeably). When used in this connection, the noun *tropos* carries some of the meaning of our term 'mode', Latin *modus*, and from one perspective a change of key brings with it a modal change; the arrangement of intervals within a given range of pitch is altered when the basic scale is shifted upwards or downwards. For Ptolemy, the main function of modulations of *tonos* is precisely the production of these 'modal' changes, which he calls 'modulations of melody' (*Harm.* 54.12–55.15, 58.7–20, cf. Porph. 169.9–26, 174.14–27); but authors who use the term *tropos* as a substitute for *tonos* do not always have this aspect of key-change in mind. In other musical contexts *tropos* can have the general sense 'style', referring, for instance, to a style of melodic composition.

- γουμενως, κατ' ἐπακολούθησιν δὲ καὶ τοῦ ἀναρμόστου· οὐ δὲ σκοπεῖται τὸ διαστηματικὸν μέλος ὅποῖον, ἀλλὰ καὶ τὴν συνεχῇ φωνὴν ἀπὸ τῆς διαστηματικῆς ἀποκρίνει, ἐπεὶ οὐδὲ τοὺς φθόγγους μόνον καταλαμβάνει,
- (25) ἐξ ὧν τὸ διαστηματικὸν μέλος καὶ ὅλως τὸ ἡρμοσμένον, ἀλλὰ καὶ τῶν ψόφων τοὺς συνεχεῖς τῶν ἀνισοτόνων ἀπὸ τῶν φθόγγων διακρίνει. καθόλου γὰρ πᾶσα ἐπιστήμη καὶ πᾶσα τέχνη οὐ μόνον τῶν καθ' ἑαυτὰς εἰσι καταληπτικά, ἀλλὰ καὶ τῶν περὶ αὐτάς, εἰ καὶ τῶν μὲν προηγουμένως, τῶν δὲ κατ' ἐπακολούθησιν. ὁ δὲ κοινότερον ἀποδοὺς τὴν ἀρμονικὴν καταληπτικὴν δύναμιν τῶν ἐν τοῖς ψόφοις περὶ τὸ ὀξύ καὶ τὸ βαρὺ διαφορῶν καὶ μηδὲ τὴν φωνήν, μηδὲ τὸν φθόγγον ἐν τῷ ὄρω τάξας, ἀλλὰ τὸν ψόφον, ὃς τῆς φωνῆς ἐπαναβέβηκεν, ἀκριβέστερον ἂν εἴη πεποιημένος τὴν ἀπόδοσιν. δύναμιν δ' ἀκουστέον οὐ τὴν παρὰ τῇ δυνάμει
- (7) λεγομένην—ἀτελής γὰρ ἡ τοιαύτη καὶ οὐπω μὲν ἐν ἔξει, ἐπιτήδειος δὲ πρὸς τὴν ἔξιν—ἀλλὰ τὴν παρὰ τὸ δύνασθαι κεκλημένην τῷ οἴαν τε εἶναι ἐνεργεῖν ἥδη τελείως πρὸς ἃ πέφυκεν, καθ' ὃ σημαίνόμενον καὶ τὰς ἔξεις δυνάμεις λέγομεν καὶ τὰς ἐπιστήμας. καὶ ἡ ἀρμονικὴ ἔξις
- (5) λέγοιτ' ἂν δυνάμεις.

**ψόφος δὲ πάθος ἀέρος πλησσομένου, τὸ
πρῶτον καὶ γενικώτατον τῶν ἀκουστῶν,**

- (8) Τὸν ψόφον γὰρ εἵληφεν, οὐ τὴν φωνήν, εἰς τὸν ὅρον, ὅτι γενικώτερον μὲν ψόφος φωνῆς. τὸ δὲ μέλος οὐκ ἐν φωνῇ μόνον συνίσταται, ἢ κατ' (10) Ἀριστοτέλην καὶ τινὰς τῶν Πυθαγορείων κυρίως ζῶου τε ἦν καὶ καθ' ὁρμήν, ἀλλὰ καὶ ἐν ἀψύχοις ὀργάνοις, ἃ ψόφου μὲν κοινωνοῦν, φωνῆς δ' οὐκ ἂν λέγοιτο κυρίως. τῶν γὰρ ἀψύχων, φησὶν Ἀριστοτέλης, οὐδὲν φωνεῖ, οὐδὲ φωνὴν προῖεται, ἀλλὰ κατὰ τινα ὁμοιότητα καὶ μεταφορὰν αὐλός τε καὶ λύρα λέγεται φωνεῖν, οὐ κυρίως μέντοι γε, καὶ ὅσα ἄλλα (15) τῶν ἀψύχων τάσιν ἔχει· τοῦτο δ' ἐστὶν ὁξύτητα καὶ βαρύτητα κέκτηται

22 ἐναρμόστου **Mg** 26 συνεχεῖς **om. T**

I γάρ **om. T** 8 ψόφον **M** II ἀψύχοις] ἀψόφοις **M**

but it discerns also, subordinately, the nature of that which is un-attuned. Again, it does not examine only the characteristics of intervallic melody, but also distinguishes continuous vocal sound from intervallic, since it does not only apprehend notes, | of which intervallic melody and that which is attuned in general are made up, but also differentiates between notes and those unequal-pitched sounds that are continuous.²¹ For in general, all branches of knowledge and all skills apprehend not only the things in their own domain but also those round about them, though they deal with the former primarily and with the latter subordinately.

Thus a person who represented harmonics more comprehensively, | as 'the power to apprehend the differences between sounds in respect of high pitch and low', and who referred neither to the voice nor to the note in his definition, but to sound, which is prior to voice, would have presented his account more accurately. We should understand by 'power' not that which is spoken of in relation to potentiality (since that kind is incomplete and not yet an actualised accomplishment, though it is a prerequisite of an accomplishment), but that which derives its name from 'having power', in the sense of being already completely capable of activity directed to its proper goals, the sense in which we speak of accomplishments and states of knowledge as 'powers'. Thus one may call accomplishment in harmonics, too, | a power.²²

[7D]

Sound is an attribute [*pathos*] of air that has been struck, the first and most inclusive kind among audible things. Ptol. *Harm.* 3.2–3

Ptolemy brought sound and not voice into the definition because sound is a more inclusive kind than voice. Melody is not instantiated only in voice, which, according to | Aristotle and some of the Pythagoreans, belongs strictly speaking only to an animal and involves appetitive impulse; it is instantiated also in lifeless instruments which, they say, have a share in sound but cannot strictly be said to have voice. For no lifeless things, says Aristotle,²³ give voice or emit a voice; the pipe and the lyre are said to give voice only by way of similitude and metaphor, not strictly, and so are those other | lifeless things which have a pitch (that is, they possess the height

²¹ On the distinction between 'continuous' and 'intervallic' sound see especially 9.34–10.27 and 83.1–87.19, and cf. Introduction 5(d).

²² It is hard to find a consistent translation for the difficult word *hexis*, literally the 'possession' of something, but often referring to an established mental condition and in particular to an acquired skill. It appears four times in this sentence; in translating it as 'accomplishment' or 'actualised accomplishment' I have tried to bring out Porphyry's meaning while preserving a degree of consistency.

²³ *De anima* 42ob.

τὴν ἐν μουσικῇ ταύτην γὰρ τάσιν λέγουσιν. ὅσα οὖν ταύτης μετέχει καὶ τοῦ μέλους, καταχρηστικώτερον εὖφωνα λέγεται καὶ φωνὴν ἔχειν. διαλέκτῳ γὰρ φησιν ἔοικε τὴν τάσιν ἔχοντα καὶ τὸ μέλος, ἐπεὶ καὶ τὴν φωνὴν ταῦτα ὁρῶμεν ἔχουσιν τὰ ἰδιώματα κατὰ τὰ μέλη.

- (20) Καὶ τῶν Πυθαγορείων δ' οἱ πλείστοι, καθ' οὓς τὰ κατὰ τὰς συμφωνίας πραγματεύεται, ἐπὶ τοῦ ψόφου τὴν θεωρίαν ἐνίσταντο τῆς ἐξηγήσεως ἀρχόμενοι. ὁ γοῦν περιπατητικὸς Ἀδραστος τὰ κατὰ τοὺς Πυθαγορείους ἐκτιθέμενος γράφει.

“Ἐπεὶ μέλος μὲν πᾶν καὶ πᾶς φθόγγος φωνὴ τίς ἐστι, πᾶσα δὲ φωνή

- (8) ψόφος, ὁ δὲ ψόφος πλῆξις ἀέρος κεκωλυμένου θρύπτεσθαι, φανερόν ὡς ἡρεμίας μὲν οὐσης περὶ τὸν ἀέρα, οὐκ ἂν γένοιτο οὔτε ψόφος, οὔτε φωνή, διὸ οὐδὲ φθόγγος. πλῆξεως δὲ καὶ κινήσεως γενομένης περὶ τὸν ἀέρα ταχείας μὲν ὁξὺς ἀποτελεῖται ὁ φθόγγος, βραδείας δὲ βαρὺς, καὶ σφοδρᾶς μὲν μείζων ἤχος, ἡρεμαίας δὲ μικρός.”

- (5) Ἡ μὲν οὖν αἰτία τοῦ ἀποδοῦναι τὸν ὄρον τῆς ἀρμονικῆς διὰ τοῦ ψόφου τοιαύτη. αὐτὸν δὲ τὸν ψόφον πάθος ἀέρος πλησσομένου, τὸ πρῶτον καὶ γενικώτατον τῶν ἀκουστῶν, ἀποδέδωκε, τὴν μὲν οὐσίαν τοῦ ψόφου ἀφορίζων ἐν τῷ πάθους αὐτὸν ἀποδιδόναι πλησσομένου ἀέρος, τὴν δ' ἰδιότητα τῆς οὐσίας περιγράφων ἐν τῷ τὸ πρῶτον καὶ γενικώτατον τῶν ἀκουστῶν προσθεῖναι. ἐπεὶ γὰρ πάθη ἀέρος πολλὰ καὶ διάφορα, οἷα καὶ τρεπομένου καὶ πηγνυμένου καὶ λεπτυνομένου καὶ ψυχομένου καὶ θερμαινομένου, πρόσκειται τὸ πλησσομένου. ἦν γὰρ τὸ ψοφητικὸν τοῦ ἀέρος πάθος ἐν πληγῇ κείμενον, ἀλλ' ἐπεὶ καὶ πλησσόμενος ἔσθ' ὅτε οὐ ψοφεῖ, πρόσκειται διὰ μὲν τοῦτο ἀκουστὸν δεῖν εἶναι, διὰ δὲ τὸ πολλὰ καὶ ἄλλα εἶναι ἀκουστά, ὅτι πρῶτόν τε καὶ γενικώτατον τῶν ἀκουστῶν. εἶδος γὰρ

17 ἔχει M 18 φασίν MT ante τὴν add. τὰ T καὶ τὸ μέλος Düring κατὰ τὸ μέλος codd.
22 ἀρχόμενος M 24 πᾶσα] ἅπασα Theo Smyrn. 50.6

1 ὁ δὲ ψόφος] ψόφος δὲ Theo Smyrn. 5 ἡρεμαίας] ἡρέμου Theo Smyrn. 12 πηγνυμένου] πνιγομένου g

or depth proper to music, for this is what they call 'pitch'). Those lifeless things, then, that can produce pitch and melody are said to be pleasant voiced and to have a voice only analogically. For in possessing pitch and melody, he says, they resemble speech, since we are aware that the voice too has these melodic characteristics.

| Most of the Pythagoreans, too, who worked on issues to do with the concords, made sound the starting-point of their studies as they set off on their exposition. Thus when Adrastus the Peripatetic is setting out the views of the Pythagoreans, he writes as follows:

Since all melody and every note is voice, and every voice is sound, and since sound is an impact in air that has been prevented from dispersing, it is clear that when there is stillness in the air no sound can occur and no voice, and so no note either. But when impact and movement arise in the air, if the movement is swift the sound produced is high pitched, and if it is slow the sound is low pitched; and if it is vigorous | the noise is greater [i.e. louder], while if it is gentle it is small [quiet].²⁴ [8D]

That, then, is the reason why Ptolemy expresses the definition of harmonics by reference to sound. He describes sound itself as 'an attribute of air that has been struck, the first and most inclusive in kind among audible things', outlining the essence of sound by representing it as 'an attribute (*pathos*) of air that has been struck', and delineating the specific character | of its essence by adding 'the first and most inclusive kind among audible things'. The reason why he adds 'that has been struck' is that there are many attributes of air, such as those arising when it is turned²⁵ or solidified or rarefied or chilled or heated. Again, since the sonorous attribute of air has its basis in an impact, but even when air is struck it does not always sound, he therefore adds | that it must be audible; and because many other things too are audible, he adds that it is the first and most inclusive kind among

²⁴ Adrastus of Aphrodisias (c. AD 100) is best known for his commentaries on Aristotle. But he also wrote a commentary on Plato's *Timaeus*, parts of which are quoted in Theon of Smyrna's *Mathematics useful for reading Plato*. Petrucci (2012) is an indispensable aid to the study of Theon's work; see his 514–30 for an extensive discussion of Adrastus' commentary. Theon quotes the present passage at 50.5–12 Hiller; related theses are found not only among writers in the mathematical tradition which Porphyry calls 'Pythagorean', but also in many Peripatetic and other sources. Cf. e.g. Archytas fr. 1 (quoted at 56.5–57.27 below), [Eucl.] *Sect. can.* 148.3–149.8 Jan (loosely and partially quoted at 90.7–23), Aristotle *De an.* 419b (quoted in part at 49.22–6).

²⁵ This is the word's literal sense; it might possibly refer to a change in the direction of a current of air. But the choice of 'being turned' as a modification of air seems strange; and whereas the other four modifications mentioned appear to form two pairs of opposites, this one is left isolated. As an anonymous reader suggests, Porphyry may have intended it to mean simply 'changed', and to designate the general category to which the other modifications belong. But in that case there must be something wrong with the text, since as it stands the Greek cannot be construed in that way.

ψόφου ἢ φωνῇ καὶ ταύτης ἐστὶν εἰδικώτερον ὁ λόγος.

- (20) Ἀριστόξενος μὲν οὖν παρήγγελλε “καθόλου δεῖν ἐν τῷ ἄρχεσθαι παρατηρεῖν, ὅπως μὴτ’ εἰς τὴν ὑπερορίαν πίπτωμεν ἀπὸ τινος φωνῆς ἢ κινήσεως ἀέρος ἀρχόμενοι, μὴτ’ αὖ ἐνδοτέρω κάμπτοντες πολλὰ τῶν οἰκείων παραλιμπάνωμεν”.

- (25) Διὰ τοῦτο γὰρ καὶ ἐπιτιμᾷν τινας εὐλόγως Ξενοκράτει, ὅτι ἐγχειρήσας ὑπὲρ τῶν διαλεκτικῶν πραγματεύσασθαι ἀπὸ φωνῆς ἄρχεται, οὐδὲν οἰομένους εἶναι πρὸς τὰ διαλεκτικὰ τὸν τῆς φωνῆς ἀφορισμόν, ὅτι ἐστὶν ἀέρος κίνησις, οὐδὲ τὴν μετὰ ταῦτα διαίρεσιν, ὅτι ἐστὶ τῆς φωνῆς τὸ μὲν τοιοῦτον, οἷον ἐκ γραμμάτων συγκεῖσθαι, τὸ δὲ τοιοῦτον, οἷον ἐκ διαστημάτων τε καὶ φθόγων· πάντα γὰρ εἶναι ταῦτα ἀλλότρια τῆς διαλεκτικῆς· καὶ οὐδὲν ἄλλο πεπονθέναι τὸν οὕτως ἀπτόμενον τῆς σκέψεως, ἀλλ’ ἢ προδιεξίναί τινὰς θεωρίας πρὸ τῆς διαλεκτικῆς οὐδὲν πρὸς αὐτὴν συναπτούσας.

- (9) Οἱ μέντοι Πυθαγόρειοι, οἷς ἔπεται ἐν τοῖς πλείστοις ὁ Πτολεμαῖος, ἀπὸ τῆς οὐσίας τῶν ψόφων καὶ τῆς φωνῆς ἤρχοντο τῆς θεωρίας δι’ αἰτίαν τήνδε. ἐκβάλλοντες γὰρ τὸ τῆς ἀκοῆς κριτήριον ὡς πρὸς πίστιν οὐκ ἐχέγγυον τῆς τῶν συμφῶνων καταλήψεως ἐπὶ τὸν λόγον καὶ τὴν διὰ τῶν ἀριθμῶν κρίσιν ἀφικνοῦντο. ἐπεὶ τοίνυν τὸ μέλος καὶ αἱ συμφωνίαι ἐν ὁξύτῃσι ψόφων καὶ βαρύτῃσι πως ἐχούσαις πρὸς ἀλλήλας συνίστανται, ὁξύτῃτος δὲ καὶ βαρύτῃτος ταχυτῆς αἰτία καὶ βραδυτῆς, ὡς δειχθήσεται ὕστερον διὰ πλειόνων, ἡ δὲ ταχυτῆς καὶ βραδυτῆς ἐν κινήσει, εἰκότως τὴν οὐσίαν τῆς φωνῆς καὶ τοῦ ψόφου ἐζήτουν, ἥτις ἐστὶν, καὶ εὐρόντες ἐν κινήσει. πάθος γὰρ ἀέρος πλησσομένου ὁ ψόφος, τῷ γένει δὲ ψόφος καὶ ἡ φωνή. τοῦντεῦθεν τὰς συμμετρίας τῶν κατὰ τὰς κινήσεις ταχῶν καὶ βραδυτήτων καὶ τοὺς λόγους τῶν συμμετριῶν ἐσκοποῦντο. πάσης δὲ συμμετρίας ἐν ἀριθμοῖς τισι θεωρουμένης εὐρόντες τὰς συμμετρίας τῶν συμφωνιῶν καὶ τοὺς ἀριθμούς, ἐξ ὧν τῆς συμμετρίας οἱ λόγοι ὑφίσταντο, τῇ τῶν ἀριθμῶν ἀκριβεῖα ἔκρινον τὰς συμφωνίας καὶ τοῖς τούτων λόγοις ταύτας παρεμέτρουν παρέντες τὴν ἀκοὴν ὡς οὐκ ἱκανὴν οὔσαν

18 παρήγγειλε g δεῖν παρατηρεῖν] παρατηρητέον Aristox. Harm. 44.17 19 ἐπιπίπτωμεν Aristox. ἢ Macran ἢ codd. 20 ἐνδοτέρω] ἐντός Aristox. 21 ἀπολιμπάνωμεν Aristox. 29 προδιεξίναί Düring προσδιεξίναί codd.

3 οὐκ om. T 4 ἐχέγγυον g 5 μέλος] τέλος p

audible things. For voice is a species of sound, and the definition of voice is more specific.

Aristoxenus indeed makes the following declaration. 'In general we must take care at the start that we do not stray into extraneous territory by beginning by treating voice as | a movement of air, and also that we do not turn back too soon and omit many things that are proper to the subject.'²⁶ This is why some people quite reasonably criticised Xenocrates for beginning his work on dialectic with a discussion of voice; for they thought that there is nothing relevant to dialectic in the definition of voice as | a movement of air, or in the distinction that follows, to the effect that there is one sort of voice that is put together from letters, and another that is put together from intervals and notes. All these matters, they thought, are irrelevant to dialectic. What had happened to the person who approached the enquiry in this way was simply that before coming to dialectic itself, he had gone through various preliminary studies which have no | connection with it.²⁷

The Pythagoreans, however, whom Ptolemy for the most part follows, began their investigation from the essence of sounds and voice for the following reason. They rejected the criterion of hearing as unworthy of trust in its apprehension of the concords, and appealed to reason and to | judgement based on numbers. Then since melody and the concords consist in certain relations between the heights and depths of sounds, and since the causes of height and depth are speed and slowness (as will be demonstrated later in several ways), and since speed and slowness belong to movement, they naturally sought to discover what the essence of voice and sound is, and found it | in movement. For sound is an attribute of air that has been struck, and voice falls under the genus of sound. Next, they investigated the proportional relations between the speeds and slownesses of the movements, and the ratios of these relations. Since every proportional relation is conceived in terms of certain numbers, they discovered the relations proper to the concords, and the numbers which make up the ratios of these relations; | and they assessed the concords with the precision provided by numbers and measured them through the ratios of these numbers, putting hearing aside as inadequate to assess such things. It was

[9D]

²⁶ Aristox. *El. harm.* 44.17–20. It is surprising that Porphyry does not explicitly point out that Aristoxenus' statement contradicts the position he has outlined, not even by beginning the paragraph with a connective meaning 'on the other hand' or 'by contrast'; no contrast is implied by the connective *men oun*, loosely represented here as 'indeed'. But he certainly intended the difference to be noticed; cf. 9.19–23 below.

²⁷ Xenocrates frag. 88 Isnardi Parente. For a discussion see Barker (2012): 315–18.

- κρίνειν τὰ τοιαῦτα. ἀναγκαῖον οὖν ἦν κατ' αὐτοὺς τὴν οὐσίαν τοῦ ψόφου καὶ τῆς φωνῆς θεωρεῖν καὶ ἄρχεσθαι ἀπὸ τῆς τούτων καταλήψεως πρὸς πᾶσαν τὴν τοῦ συμφώνου εὗρεσιν διὰ τὴν κίνησιν. τοῖς παραιτούμενοις
- (20) μὲν τὴν διὰ τῶν ἀριθμῶν καὶ τοῦ λόγου κρίσιν τῆς συμφωνίας, αὐτόθεν δ' ἀξιοῦσι τῇ αἰσθήσει κανόνι χρῆσασθαι—τούτῳ ὡς ἀρχοειδεῖ ἐν τῇ τοῦ ἡρμοσμένου καταλήψει—ἀλλότριον γίνεται καὶ πόρρω παντελῶς τὸ τὴν οὐσίαν τῶν ψόφων καὶ τῆς φωνῆς ἐρευνᾶν. ταῦτα μὲν οὖν τοιαύτην ἔχει τὴν λύσιν.
- (25) Ὁ δὲ Πτολεμαῖος ὅτι ἐν πολλοῖς πρὸς τοὺς Πυθαγορείους ἀποκλίνει κατὰ τὴν ἀρμονικὴν πραγματείαν, δειχθήσεται μὲν τοῦ λόγου προϊόντος μᾶλλον· νῦν δὲ καὶ ἀπὸ τούτων γινέσθω φανερόν. πάντων γὰρ ὡς ἔπος εἰπεῖν τῶν Ἀριστοξενείων καταρχὰς τῆς διδασκαλίας περὶ φωνῆς σκο-
 (30) πουμένων οὐ τῆς οὐσίας αὐτῆς—ἀπέγνωσται γὰρ τοῦτο ὑπὸ τοῦ καθη-
 γεμόνος τῆς αἰρέσεως—ποίας δ' ἔχει διαφορὰς ἀποδιδόντων, καὶ τὴν μὲν ἀρμονικὴν γνῶσιν φωνῆς ἀνθρωπίνης τε καὶ ὀργανικῆς καὶ τῆς ταύ-
 ταις παρακειμένης, τίνα τρόπον πεφύκασιν κινούμεναι φυσικῶς ἀναστρέφε-
 σθαι καὶ τοῦ ἰδίου περιγίνεσθαι τέλους ὀριζομένων, τὰς δὲ τῆς φωνῆς διαφορὰς ἐξῆς παριστάντων. διττὴ γὰρ φασιν ἢ ταύτης κίνησις, ἢ μὲν
- (10) λεγομένη συνεχῆς, ἢ δὲ διαστηματική, συνεχῆς μὲν, καθ' ἣν πρὸς ἀλ-
 λήλους διαλεγόμεθα, ὅθεν καὶ λογικὴ συνωνύμως καλεῖται· διαστημα-
 τικὴ δὲ, καθ' ἣν ᾔδομέν τε καὶ μελωδοῦμεν, αὐλοῦμέν τε καὶ κιθαρίζο-
 μεν, ὅθεν καὶ μελωδικὴ προσαγορεύεται· τῆς διαφορᾶς αὐτῶν θεωρου-
 (5) μένης, ὅτι ἢ μὲν συνεχῆς εἰρμοῦ τινος καὶ τάχους κατὰ τὴν προφοράν,
 πυκνότητός τε καὶ τοῦ ἐπ' ἀλλήλου τῶν μορίων, ἐξ ὧν συνέστηκε, φαν-
 τασίαν ἐγγενᾶ τοῖς ἀκούουσιν, ἢ δὲ διαστηματικὴ πᾶν τοῦναντίον, οὐ
 ταχυτήτος, οὐδ' εἰρμοῦ, μετ' ὀξύτητος δὲ τινος κατὰ λεπτά μερισμοῦ
 ἐμποιεῖ κατάληψιν, ὥστε ἀπλῶς ὑπολαμβάνειν, ὅτι ἢ μὲν προτέρα κί-
 (10) νησις τῆς φωνῆς σπεύδει καὶ προαίρεσιν ἔχει μηδαμοῦ στήναι. κατὰ
 μόνας γοῦν τὰς τελευταίας ἀποσιωπῆσεις ἴσταται καὶ τὸν ἴδιον δρόμον

21 τούτῳ] τούτων **m** 29 ἀπέγνωσται *scripsi* ὑπέγνωσται **mp** ἐπέγνωσται *ceteri* 31 ταύταις]
 ταύτης **p** 32 κοινούμεναι **M** 34 φησὶν **p**

2 συνωνύμος **p**

therefore necessary for them to study the essence of sound and voice and to begin from an understanding of them, in order to discover fully what is concordant by reference to movement. But to those who criticise | the procedure of assessing concordance by means of numbers and reason, and who think it proper to turn directly to perception as the yardstick (on the grounds that it is fundamental to the apprehension of that which is attuned), the quest for the essence of sounds and voice is utterly irrelevant and far from the mark. Such, then, is the way these issues can be resolved.

| As the discussion proceeds it will show more fully that in many respects Ptolemy leans towards the Pythagoreans in connection with the enterprise of harmonics; but for the present let us use the following points to make it clear.²⁸ Virtually all the Aristoxenians, when examining voice at the outset of their teachings, do not explain its essence (since that topic had been renounced by the leader | of the school) but set out the different attributes it can have. They define harmonics as the science of human, instrumental and related types of voice, which studies the ways in which they naturally proceed in the course of their movement and reach their characteristic completion; and they then pass immediately to the voice's various attributes. For they say that its movement is of two sorts, one called 'continuous', the other 'intervallic'.²⁹ The continuous kind is that through which we converse with one another; hence it is also, equivalently, called 'proper to speech'. The intervallic sort is that through which we sing and make melody or play the pipes and the kithara; hence it is also named 'melodic'. The difference between them is understood through the fact | that the continuous kind creates in its hearers the impression of something strung together, of rapid progress, and of its constituent parts being packed closely up against one another; whereas the intervallic kind, in complete contrast, implants an apprehension neither of rapidity nor of something strung together, but of a cleanly cut division into small parts. Thus, to put it straightforwardly, the first type of vocal movement | hurries on and is determined to stand still nowhere; at any rate, it stands still and arrests its characteristic course only in its final silences. The second kind habitually

[10D]

²⁸ Theiler and Alexanderson may be right in construing the text from here to 'his study of harmonics' at 10.30 as one enormous sentence, interrupted by an elephantine parenthesis at 9.34–10.27; but I have not attempted to recreate this construction, and I have preserved Düring's paragraph-break at 10.27, which it would remove.

²⁹ The ultimate source of this statement and the discussion that follows is Aristox. *El. harm.* 8.13–10.20. The passage was repeatedly quoted or paraphrased by later writers, and Porphyry's discussion is plainly derived from it; but it includes a number of variations that substantially affect the sense. See Introduction Section 5(d).

- ἐπέχεται. ἡ δὲ δευτέρα φιλεῖ πως διαναπαύεσθαι καὶ καθ' ἕκαστον, ὧν προφέρεται μορίων, λήγουσα εὐθύς ἡρεμεῖ, εἴτ' ἡρεμήσασα ὥσπερ ἀπ' ἄλλης ἀρχῆς πάλιν ἄρχεται καὶ χρῆται τῇ τε διαναπαύσει καὶ τῇ προφορᾷ
- (15) μιᾶ παρὰ μίαν ἐναλλάξ. διὸ καὶ κατὰ μὲν τὸ λέγειν περιϊστάμεθα τὸ πολλὰκις ἀποσιωπᾶν. ὥδῃς γὰρ καὶ μελωδίας ἴδιον τοῦτο. κατὰ δὲ τὸ ᾄδειν προνοούμεθα τοῦ μηδαμῶς συνάπτειν τὰ μόρια· συνεχοῦς γὰρ φωνῆς παρακολούθημα καὶ τοῦτο, ὅθεν καὶ τοὺς μὲν ἐν τῷ διαλέγεσθαι δυσφόρους καὶ κατ' ὀλίγας λέξεις σταλάττοντας ὡς μὴ καθικνουμένους
- (20) τοῦ τῆς λαλιᾶς ιδιώματος ψέγομεν, τοὺς δὲ λίαν κατεσπευσμένους ὥδῃς καὶ τροχαλῶς παραφέροντας πάλιν οὐκ ἐπαινοῦμεν, κἄν γὰρ τὰ μάλιστα ἑαυτοῖς τεχνῖται δόξωσιν εἶναι καὶ δυσκόλως ᾄδειν, ἀλλ' οὖν ὁμως ᾄδουσιν οὐ χωρὶς τοῦ καὶ τὸ μέλος διὰ τὴν πυκνότητα καὶ τὴν πρὸς τὴν ἐτέραν φωνὴν συγγενισμόν ποιεῖν ἀσχημονεῖν. ὅσω μὲν γὰρ ἂν ταχύνηται
- (25) καὶ λίαν ἐλαύνηται τὸ μέλος, παρ' ὀλίγον συνεχὲς ἀναγκαζόμενον εἶναι, κακοτεχνεῖται, ὅσω δ' ἂν ἀναβεβλημένος παρέλκηται καὶ βραδύνηται, σαφὲς καὶ περίτρανον φαίνεται καὶ μᾶλλον εὐσχημονοῦν.

- Τοιοῦτων οὖν σχεδὸν παρὰ πᾶσι τοῖς Ἀριστοξενεῖσι λεγομένων εὐθύς καταρχὰς τοῦ περὶ τῆς ἀρμονικῆς σκέμματος ὁ Πτολεμαῖος ταυτὶ παρῆρηται. τὴν δ' ἀρμονικὴν διὰ τοῦ ψόφου ὑπογράψας, ἀλλ' οὐ διὰ τῆς φωνῆς καθάπερ τοῖς Ἀριστοξενεῖσις ἔθος, περὶ τῆς οὐσίας τοῦ ψόφου διελέχθη, ὃ δοκεῖ μὲν τοῖς Πυθαγορείοις παραιτούμενοι δὲ τοῦτο οἱ ἀπ' Ἀριστοξένου φαίνονται. ἀλλὰ ταῦτα μὲν περὶ τῆς προαιρέσεως τάνδρος εἰρήσθω, σκεπτέον δέ, ἃ περὶ τοῦ κριτηρίου ἐξῆς ἐπάγει, γράφων ταῦτα.

- (II) καὶ κριτήρια μὲν ἀρμονίας
ἀκοή καὶ λόγος, οὐ κατὰ τὸν αὐτὸν δὲ τρόπον, ἀλλ' ἡ μὲν ἀκοή παρὰ τὴν ὕλην καὶ τὸ πάθος, ὃ δὲ λόγος παρὰ τὸ εἶδος καὶ τὸ αἶτιον. [5]

- Κριτήρια μὲν οὖν οὐ μόνον τῶν περὶ τοὺς ψόφους διαφορῶν καὶ τῆς
- (5) τούτων ἀρμονίας αἰσθησιν καὶ λόγον οἱ παλαιοὶ ἐτίθεντο, ἀλλὰ καὶ πάντων ὁμοίως τῶν αἰσθητῶν. τὰ μὲν γὰρ λόγῳ κρινόμενα μὴ πάντα καὶ αἰσθήσει κρίνεσθαι, τὰ δ' αἰσθήσει πάντως καὶ λόγῳ. αἰσθησιν δὲ καὶ λόγον ἐκάλουν τὰς τε δυνάμεις τῆς ψυχῆς καὶ τὴν αἰσθητικὴν λέγω καὶ τὴν λογικὴν καὶ τὰς χρήσεις τῶν δυνάμεων· καὶ εἶναι μὲν εἶδους ἀντίληψιν καὶ κατὰ τὴν αἰσθησιν καὶ κατὰ τὸν λόγον, ἐπεὶ κατ' εἶδη εἶναι καὶ
- (10)

20 κατεσπευσμένους ME κατεσπευμένους T κατεσπασμένους G κατεσπασμένους p 23 οὐ χωριστόν
p 24 συγγενισμόν] συνεγγισμόν Wallis 26 ἀναβεβλημένους ETV¹⁸⁷ 27 φαίνεται] γίνεται
T 30 τῆς om. g 32 δοκεῖ Düring ποιεῖ codd.

6 ὁμοίως om. T πάντα] πάντως T 10 κατ' scripsi anonymum lectorem secutus καὶ codd.

pauses for a while upon each of the parts it presents, and when it pauses is immediately at rest; after resting it makes as it were a new beginning, and it makes intermittent pauses and forward movements | alternately, one by one. Hence when speaking we avoid frequent silences, since they are characteristic of song and melody. But in singing we take care not in any way to join up the parts, since that is something that goes with the continuous kind of voice. This is why we find fault with people whose speech lacks fluency and who break their utterances up into little drips, on the grounds that they have failed to achieve | what is characteristic of talking; and again, we do not approve of those who hurry songs along too urgently and hastily. For even though they strike themselves as first-rate executants and as singing in a very difficult manner, nevertheless when they sing they cannot avoid disfiguring the melody, because of the close packing of its parts and its affinity with the other kind of voice. For to the extent that the melody is accelerated | and driven on too fast, and is forced to be all but continuous, it is the product of bad artistry; and to the extent that it is drawn out and slowed down in a measured way, it presents itself as clear and distinct, and more elegantly displays its proper form.

Thus while pretty well all of the Aristoxenians say things of this sort, Ptolemy distanced himself from them right at the beginning of his study of harmonics. | In delineating harmonics by reference to sound, and not by reference to voice as the Aristoxenians regularly do, he was speaking of the essence of sound, in the manner of the Pythagoreans; whereas the followers of Aristoxenus evidently decline to address this subject. Let that suffice about Ptolemy's choice of approach; we must now investigate what he adds next about the criterion. He writes as follows.

And the criteria of attunement (*harmonia*) are hearing and reason (*logos*), but not in the same way; hearing judges on the basis of the matter and the attribute (*pathos*), reason on the basis of the form and the cause. Ptol. *Harm.* 3.3–5 [11D]

The ancient writers made perception and reason the criteria not only of differences in sounds and of the | attunement of sounds, but also of all perceptible things alike. In their view not all things judged by reason are judged also by perception, but all those judged by perception are judged also by reason. They gave the names 'perception' and 'reason' both to the faculties of the soul (I mean the perceptual and rational faculties) and to the uses of these faculties; and they said that there can be apprehension (*antilepsis*) of form | both in accordance with perception and in accordance

- τὴν αἴσθησιν καὶ τὸν λόγον. ἀλλ' ἤδη τὸν μὲν αὐτοῦ μόνου τοῦ εἶδους ἀντιλαμβάνεσθαι, ὡς συμβέβηκεν ἐγγίνεσθαι τῇ ὕλῃ, τὴν δὲ κατὰ προσπαράληψιν τῆς ὕλης. τοῦ γὰρ εἶδους ἡ αἴσθησις καθ' ὃ ἔνυλον. καὶ γὰρ ἡ μὲν μετὰ σώματος καὶ πάθους κινεῖται εἰς ἀντίληψιν, κατ' ἐνίου
- (15) δ' οὐδ' ἄλλο τι ἐστὶν ἢ πάθος, ὥσπερ ἔοικε καὶ ὁ Πτολεμαῖος τίθεσθαι. ὁ δ' ἀπαθῶς καὶ ἀσωμάτως ἐνεργεῖ, τὴν οὐσίαν ἐν ἀύλῳ εἶδει καὶ ἐνεργεῖα κεκτημένος. οὕτως οὖν καὶ τοὺς ὄρους κατὰ τὸ εἶδος καὶ τὴν οὐσίαν ἀποδιδόντες τοὺς μὲν τινὰς ποιοῦμεθα κατ' αὐτὸ τὸ εἶδος, τοὺς δὲ κατὰ τὴν μεῖξιν τοῦ εἶδους πρὸς τὴν ὕλην. πολλάκις δὲ καὶ τῆς ὕλης γίνονται
- (20) τινες ὀρίσμοί, μᾶλλον δὲ κατὰ τὴν ὕλην, ὅτι δέχεται τὸ εἶδος καὶ ἔστιν αὐτοῦ δεκτικὸν αὕτη. διὸ καὶ τρεῖς οἱ ὅροι, οἱ μὲν ἐννοητικοὶ οἱ τοῦ εἶδους, οὓς μᾶλλον οὐσιώδεις καλεῖ Ἀριστοτέλης, οἱ δ' ὑλικοί, οὓς οἱ Στωικοὶ καλοῦσι μόνον οὐσιώδεις, οἱ δὲ κατὰ τὸ συναμφοτέρον, οὓς μάλιστα ὁ Ἀρχύτας ἀπεδέχετο. καὶ πάντες μὲν εἰσι τρόπον τινὰ τοῦ
- (25) εἶδους, ἀλλ' οἱ μὲν αὐτοῦ μόνου, ὡς συμβέβηκεν ἐγγίνεσθαι τῇ ὕλῃ, οἱ δὲ κατὰ προσπαράληψιν τῆς ὕλης, οἱ δὲ κατὰ τὸ δεκτικὸν μόνον αὐτῆς. οὕτω γὰρ καὶ ἡ φωνὴ φέρεται καὶ ὁ ψόφος λέγεται καὶ τὸ ἴδιον αἰσθητὸν ἀκοῇ καὶ ὁ πεπληγμένος ἀήρ κινητικὸς ἀκοῇ καὶ αὕτη ἡ πληγὴ κίνησις

II τόν^{ecc}] τοῦ M 12-13 παράληψιν ETV¹⁸⁷ 16 αὐλῳ in marg. ἐνύλῳ T 17 οὕτως scripsi
 ὡσπερ codd. 28 πληγῇ scripsi πληγὴ codd. ἀκοῆς bis p αὕτη T

with reason, since both perception and reason are concerned with forms.³⁰ They said also, however, that reason grasps only the form itself, as it is on occasions when it becomes present in matter, while perception's grasp incorporates the matter in addition. For perception is of the form as enmattered. It is moved, so as to gain an apprehension of something, along with the body and the way it is affected, and according to some people | is nothing but being affected, as Ptolemy too seems to posit.³¹ Reason, by contrast, acts without being affected and without the body, and embraces the essence in its non-material form and activity. Thus when expressing definitions by reference to form and essence, we construct some of them by reference to the form itself, and others through a blending of form with matter. Often, too, there are specifications of the matter, | or rather in respect of the matter, to the effect that it receives the form and is itself something capable of receiving it. Hence there are three kinds of definition.³² Some, the definitions of form, are grounded in thought; Aristotle describes them as more closely akin to the essence. Others are of the matter, and these alone are described as akin to the essence by the Stoics.³³ Others again refer to both together, and it is these that Archytas accepted as the best. All of them are of the form in one way or another, | but some are of the form alone as it is when it arises in matter, some incorporate the matter in addition, and some specify only the matter's capacity to receive the form.

This is the way in which voice is represented; and sound is described both as that which is perceptible specifically to the hearing, and as air that has been struck and is capable of moving the hearing, and again as the air's movement itself under the agency of an impact. Just as all these

³⁰ In most of its occurrences, *antilepsis* is closely linked to sense-perception, sometimes (e.g. at 16.1–2 below) treated as a phase in the perceptual process itself, which develops from the mere, passive reception of a stimulus to a preliminary 'apprehension' of the character of its external cause. See further 13.24–7, 14.6–7 below, and cf. e.g. Alex. Aphr. *In Ar. de sensu* 132.23 ff. Wifstrand. In some passages, however, Porphyry uses the term to refer to 'apprehensions' arising from the use of reason, in which sense-perception plays no part; see e.g. 17.24–6 below.

³¹ The meaning of *pathos*, represented here by 'the way it is affected', cannot be expressed by a noun in modern English. (In earlier times it could, since the word 'affection' was capable of designating both; but the usage is now obsolete.) The sense of the first clause, I think, is that in the process of perceiving, the body of the perceiver is itself 'affected' and its attributes are altered.

³² The ancestor of this remark and of its expansion in the next few lines (but not of course its reference to the Stoics) is Aristotle *Metaph.* 1043a14–26, printed in part as DK47 A22 (Archytas).

³³ This does no justice to Stoic accounts of definition, on which see the texts and commentary in Long and Sedley (1987 vol. 1): 190–5. It seems to reflect only the fact that their ontology officially recognises only bodies as genuine 'beings', though certain incorporeal items were also admitted into the broader category of 'somethings'. For a lucid account of Stoic metaphysics see Brunschwig (2005), especially 210–12 on bodies and definitions.

- τοῦ ἀέρος. ὥς οὖν οὗτοι τοῦ εἶδους ὄντες διαφόρως ἀπεδόθησαν, οὕτω καὶ τὰ φυσικὰ κριτήρια· πάντα μὲν τοῦ εἶδους ἐστὶ καὶ κατ' αὐτὸ κινεῖται, ἀλλ' ἢ μὲν αἰσθησις, ἣ ἔνυλον τὸ εἶδος, ὃ δὲ λόγος χωρίζων αὐτὸ ἀπὸ τῆς ὕλης. ἔνθεν καὶ δοκεῖ τισιν τὸν μὲν τῆς οὐσίας εἶναι κριτικόν—οὐσίας γὰρ τὰ εἶδη καὶ οἱ παλαιοὶ ὑπελάμβανον—τὴν δὲ τῶν οὐσιωμέ-
- (12) νων, οὐσιώμενα δ' εἶναι τὰ εἶδη σὺν ὕλῃ ἢ ἐν ὕλῃ, μηδ' ἁρμονίας οὖν κριτικὴν εἶναι τὴν αἰσθησιν ἀλλὰ τοῦ ἡρμοσμένου. διαφέρει γὰρ τὸ ἡρμοσμένον ἁρμονίας, ἣ τὸ ἀριθμητὸν ἀριθμοῦ· εἶναι γὰρ τὸ μὲν ἀριθμητὸν ἀριθμὸν ἐν ὕλῃ ἢ σὺν ὕλῃ, τὸ δ' ἡρμοσμένον ἁρμονίαν ἐν ὕλῃ ἢ σὺν ὕλῃ· ὑπάρχειν δὲ τὸν λόγον οὐ μόνον κριτὴν τῶν αἰσθητῶν ὥς τὸ εἶδος, ἀλλὰ καὶ ὥς τὸ αἴτιον. πολλαχῶς δὲ τοῦ λόγου λεγομένου λέγεται οὐχ ἥττον λόγος καὶ ὁ φυσικός, ὃ τε τῆς σπερματικῆς δυνάμεως καὶ ὁ κατὰ τὴν σύνταξιν τῶν αὐτῆς τῆς φύσεως ἐνεργειῶν. λέγουσι δὲ καὶ οἱ μαθηματικοὶ τῶν ἀριθμῶν λόγον, οἷός ἐστι καὶ τραπεζητικός, καὶ τὸν τῆς τῶν ὁμογενῶν πρὸς ἄλληλα σχέσεως ἐν ταῖς ἀναλογίαις. διὸ καὶ κυριώτατος καὶ πάντων προηγούμενός ἐστι λόγος ὁ ἅμα τε τὴν σχέσιν ἔχων καὶ τὸν συμψηφισμόν τῆς συγκεφαλαιώσεως τῆς φυσικῆς τῶν πραγμάτων, ὃν ὥσπερ μεμίμηται καὶ ὁ τῆς ψυχῆς λογισμός. οὗτος δ' ἐστὶν ὁ τῆς ὕλης εἰδοποιός. εἰδοποιεῖται γὰρ ἡ ὕλη καθάπερ ἐξαριθμουμένη
- (5)
- (10)

4 τό— 5 ὕλη om. T 8 τὴν om. g αὐτῆς] αὐτῶν G 9 τὸν ἀριθμὸν G τόν] τῶν g

are of the form but are differently expressed, so it is with | the natural criteria; for all of them are criteria of the form and are activated in relation to it, but perception is of the form as enmattered, while reason separates it from the matter. This is why some people think that reason is the judge of the essence (since the ancient writers, too, took the forms to be essences), while perception is the judge of things that have acquired an essence, these being forms with matter or in matter, and that perception [12D] is therefore not the judge of attainment but of that which is attuned. For that which is attuned differs from attainment as that which is numbered differs from number, since that which is numbered is number in matter or with matter, and that which is attuned is attainment in matter or with | matter.

They say that reason is the judge of perceptible things not only in that it is form, but also as their cause.³⁴ For reason (*logos*³⁵) is spoken of in many senses, and not least as 'reason in nature', both that which has generative power³⁶ and that which brings order to the activities of nature itself. Mathematicians also speak of a *logos* ('ratio') of numbers – the word's usage in finance is of a similar sort – and when making proportional comparisons they speak of the *logos* | of the relation between things of the same kind.³⁷ Hence the supreme *logos*, pre-eminent above all others, is that which includes simultaneously the relation between things and the reckoning of the natural totality of things; and it is as it were imitated by the reasoning (*logismos*) of the soul. It is this *logos* that gives form to matter. For matter is given form as if by being enumerated | and summed into

³⁴ On the passage from here to 15.28 see Introduction Section 4(a), and Tarrant (1993): 108–47. He takes all or most of it to be derived from the work of Thrasyllus, in some parts as direct or nearly direct quotation, in others as a looser paraphrase. Tarrant's arguments are intriguing, and no doubt Porphyry developed his discussion, here as elsewhere, on the basis of ideas taken from other philosophers. Thrasyllus may well have been among them. But I do not think that there are sufficient reasons for supposing that he is Porphyry's only or even his principal source throughout; the only segment plainly attributed to him is 12.21–8.

³⁵ Wherever 'reason' appears in my translation of this passage, it represents *logos*; the word is often used in this sense elsewhere in the commentary, and also to mean 'ratio'. The sense 'ratio' is not in play in the present passage, but 'reason' does not always seem appropriate either; and in such cases I have marked the presence of the word *logos* either by adding the transliteration to the translation, or by simply transliterating without translating. With this passage on the various meanings of *logos* cf. Porph. *In Ar. Cat.* 64–5 Busse.

³⁶ For the Stoic notion of the 'generative' (*spermatikos*) *logos* see e.g. D. L. VII.136, 148, 157, Plutarch *Quaest. conv.* 641A, Sext. *Emp. Adv. math.* IX.101–3; cf. the quotation from Thrasyllus in Porphyry's next paragraph. For its treatment by Neoplatonists see e.g. Plot. *Enn.* III.1.7, IV.4.39; Porph. *In Ar. Cat.* 64–5 Busse, *Peri agalm.* 3.47, 8.106 Bidez; Iamblich. *De myst.* 3.28.34–42, *In Nic. arithm.* 10.13, 81.22 Klein. The idea that *spermatikoi logoi* inherent in the universe are the sources from which things in the natural world have developed appears frequently in later philosophical and theological writings.

³⁷ Cf. Eucl. *El.* V def. 3, quoted at 90.24–91.1 below.

- (15) καὶ κεφαλαιουμένη μετὰ συντάξεως τῆς πρὸς ἄλληλα τῶν προσεγγινομένων αὐτῇ παθῶν καὶ διαθέσεων κατὰ τὴν πρὸς ἄλληλα αὐτῶν σχέσιν καὶ συμφωνίαν, ὧν ἀναλόγως συναρμοζομένων κατὰ τε τὰς ἐκάστων ἀπεργασίας καὶ τὴν τοῦ παντός περιοχὴν τὰ ὅλα διοικεῖται, ᾧ χρηταὶ λόγῳ καὶ λογισμῷ καθάπερ ἱερὰν ἔχων ἐπιστήμην καὶ διανόησιν ὁ τῶν ὅλων ἡγεμὼν θεὸς καὶ καθ' ὃν ἡ φύσις ἕκαστα τῶν ἐν τῷ κόσμῳ παρέχεται.
- (20) Καὶ οὗτός ἐστιν ὁ τῶν εἰδῶν λόγος, ὡς φησὶν ὁ Θράσυλλος, “συνεσπειραμένος μὲν ἐν τοῖς σπέρμασι καὶ ὥσπερ ἐγκεκρυμμένος, ἐξαπλούμενος δὲ καὶ ἀνελιττόμενος κατὰ τὰς ἐκάστης φύσεως ἐνεργείας, ἐγγιγνόμενος δὲ κατὰ μίμησιν καὶ τοῖς τεχνικοῖς θεωρήμασιν, ὡς καὶ
- (25) τοῖς τεχνικοῖς αὐτοῖς ἀποτελέσμασι καὶ τῷ τῆς διανοητικῆς φρονήσεως καὶ σοφίας λογισμῷ, καθ' ὃν ὃ τι ποτ' ἐστὶν ὁ νοῦς ἐπισφραγίζεται καὶ τὸ τί ἦν εἶναι ἐκάστῳ καθορίζεται τε καὶ πιστοῦται, οὐ καὶ ὁ ὀριστικός καὶ ὁ ἀποδεικτικός λόγος ἐστὶ δηλωτικός.”
- (30) Καὶ γὰρ ὁ ὀρισμὸς οὐκ ἄλλο τι ἐστὶν ἢ καθάπερ ἐξαρίθμησὶς τις τεταγμένη <καὶ> συνεψηφισμένη τῆς διαφορᾶς τῶν πραγμάτων, καὶ ἡ ἀπόδειξις ὥσπερ συναγωγὴ τίς ἐστὶν ἐκ διεστώτων εἰς τὸ αὐτὸ τῶν κατὰ τὸν
- (13) ὀρισμὸν συνεληλυθότων παραλλαγμάτων. διὸ καὶ τοῦ συμβεβηκότος ἐφάπτεται τὰ πολλὰ· ταῦτα γὰρ διέστηκε. τῷ δ' ὄρω μᾶλλον τὰ ἐκ τῆς οὐσίας εἶδη συνάγειν ἀναγκαῖον. ὁ μὲν γὰρ ὀρισμὸς τὴν φαινομένην διαίρεσιν τῶν γενῶν εἰς τὰ εἶδη καὶ τὰς διαφορὰς συντίθησιν, οἷον τὸ
- (5) ζῶον καὶ τὸ ὑλακτικόν, εἰς τὴν δήλωσιν τοῦ τί ἦν εἶναι· οἷον ὁ τί ἐστὶν ὁ κύων, ζῶον ὑλακτικόν. ἡ δ' ἀπόδειξις διεστώσας τὰς διαφορὰς καὶ μεσαζομένας συνάγει πρὸς τὸ ἅμεσον τὴν αἰτίαν αὐτῶν τῆς συνδέσεως ἐπιλογιζομένη. ὁ γὰρ λέγων “πᾶν τὸ βαρὺ κάτω φέρεται· ἡ δὲ γῆ ἐστὶ βαρεῖα· κάτω ἄρα φέρεται” οὐδὲν ἄλλο εἴρηκεν ἢ τὴν αἰτίαν, ὅτι ἡ γῆ
- (10) κάτω φέρεται διὰ τὸ βαρεῖαν εἶναι καὶ ὅτι γε ἡ γῆ κάτω φέρεται τῷ βάρει, ὃ ἐστὶν ὥσπερ ὁρος αὐτῆς. ἡ γῆ γὰρ ἐστὶ τὸ φύσει τὸν μέσον τόπον ἐπέχον σῶμα. ὁ δὲ μέσος ἐστὶν ἐν τῷ κόσμῳ ὁ κάτω. διὰ μὲν

27 οὐ om. Mg 29–30 τις τεταγμένη <καὶ> συνεψηφισμένη Düring τινος τεταγμένη, συνεψηφισμένης Tarrant τινὸς τεταγμένης συνεψηφισμένη codd.

2 συνέστηκε T 8 λογιζομένη T 10 κάτω φέρεται^{prim.}] καταφέρεται p

a totality, along with the imposition of order on the mutual relationships between the attributes and conditions that it additionally acquires, so that they are related in concord with one another. It is through the proportional attunement of these to one another, both in the completion of each individual thing and in the whole that contains them, that the universe is organised and governed. This is the reason (*logos*) and the reasoning (*logismos*) employed by the god who is | lord of the universe in the manner of one whose knowledge and thought are divine, and in accordance with which nature brings forth all things in the cosmos.

This, as Thrasyllus says, is

the *logos* of the forms, which is wrapped up and as it were hidden inside the seeds, but is unfolded and unrolled in accordance with the activities of each nature, and is present by imitation also in the theoretical principles of the crafts, as again in | their products themselves and in the reasoning (*logismos*) of intellectual understanding and wisdom, in correspondence with which the intelligence (*nous*) makes an impression of what a thing is and demarcates and confirms the essence of each thing, which is expressed by the *logos* that defines and the *logos* that demonstrates.

A definition is simply something like an organised and totalled up enumeration | of the way in which one thing differs from others, while a demonstration is as it were a drawing-together into one of the differing attributes that have come together in the definition as separate items.³⁸ This is why for the most part a demonstration deals with incidental attributes, since these are separate. A definition must rather draw together the forms belonging to the essence. For a definition converts a perceptible subdivision of a genus into a combination of form [or 'species', *eidōs*] and differentia, such as | 'animal' and 'barking', in order to reveal the essence, as in: 'What is a dog? – An animal that barks.' But a demonstration draws together into an immediate relation attributes that are separated, and are connected through the medium of others, by reasoning out the cause of their inter-connection. Thus if someone says 'Everything heavy travels downwards; earth is heavy; therefore it travels downwards', he is doing nothing but specifying the cause, which is that earth | travels downwards because it is heavy, and indeed that earth travels downwards through its weight, which is in effect its definition. For earth is the body which by nature occupies the place in the middle, and the middle place in the universe is the one below.

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³⁸ The text of this sentence may be faulty; see Tarrant (1993), 117, with nn. 24–5. I am not convinced that more elaborate emendations than Düring's are necessary, and have made the best sense I can of his reading.

δὴ ταῦτα καὶ τὰ τούτοις ὅμοια, ὧν πλήρη τὰ τῶν παλαιῶν συγγράμματα, ὁ λόγος πανταχοῦ κατὰ τὸ εἶδος τέτακται καὶ τὸ αἴτιον.

- (15) Ἡ μέντοι γ' αἴσθησις διὰ τὰ εἰρημένα κατὰ τὴν ὕλην καὶ τὸ πάσχον ὕλην δὲ ψυχικὴν, ἐπεὶ καὶ πάντα τὰ ὑποβεβηκότα προσεχῶς ὕλαι τῶν ἐπαναβεβηκότων· οὕτω γάρ που καὶ ὕλικός νοῦς λέγεται καίπερ ὧν ἀμιγῆς σωματικῇ ὕλῃ, ὅτι τοῦ θύραθεν καὶ ἐπαναβεβηκότος νοῦ ἐν χρειαί τῆς οἰκειάς ἐνεργείας ὡς ὕλη ἐτύγχανεν. αἱ δὲ κρίσεις ὅπως
- (20) ἐκτελοῦνται σαφεῖς γενόμεναι ἱκανὴν τοῖς ῥηθεῖσι παρέξουσιν τὴν μαρτυρίαν. τῆς γὰρ ὕλης εἰδοπεποιημένης ὑπὸ τοῦ ῥηθέντος λόγου τὴν ψυχὴν συμβέβηκε τοῖς οὖσιν ἐφισταμένην καὶ οἷον ἀποσπῶσαν αὐτῆς ἀπὸ τῆς ὕλης τὰ εἶδη καὶ δεχομένην εἰς ἑαυτὴν καὶ τρόπον τινὰ ἀποκαθιστᾶσαν εἰς τὸ αὐλον γίνεσθαι τὴν κρίσιν. τὸ μὲν γὰρ πρῶτον ἀπὸ τῆς αἰσθήσεως
- (25) ἢ ἀντίληψις, οἷον ἐπαφωμένη τοῦ ὄντος ἀναλαμβάνειν αὐτὰ πειρᾶται καὶ οἷον εἰσαγγέλλειν τε καὶ εἰσάγειν εἰς τὴν ψυχὴν ὥσπερ ὁδηγός τις καὶ εἰσαγωγεὺς. μετὰ δὲ ταῦτα ἡ δοξαστικὴ ὑπόληψις ὑποδέχεται τὸ εἰσαχθὲν προσαγορεύουσα αὐτὸ καὶ ἀναγράφουσα διὰ λόγου τῇ ψυχῇ, οἷον εἷς τι γραμμάτιον ἐνυπάρχον αὐτῇ. τρίτη δ' ἐστὶ μετὰ ταῦτα δύναμις εἰκονιστῇ τῶν ἰδιωμάτων καὶ ὄντως ζωγραφικὴ τις ἢ πλαστικὴ ἢ
- (30) φαντασία οὐκ ἄρκουμένη τῷ τῆς προσαγορεύσεως εἶδει καὶ τῷ τῆς ἀναγραφῆς, ἀλλ' ὅνπερ τρόπον οἱ τοὺς καταπλέοντας εἰκονίζοντες [ἦ] κατὰ τοὺς τοῖς συμβόλοις παρακολουθοῦντας τὴν ἀκρίβειαν τῆς ὁμοιότητος

14 κατὰ τὸ εἶδος om. T συντέτακται T 17 in marg. Τὰ πορφυρίου περὶ τοῦ ὕλικου νοῦ καὶ τὰ θύραθεν g 18 σωματικῇ ὕλῃ Cantabr. gr. 1308 σωματικῇ ὕλῃ ceteri 19 in marg. πῶς αἱ κρίσεις ὑπὸ ψυχῆς γίνονται τῶν πραγμάτων T 23 ἀποκαθιστῶσαν p 29 εἷς τι] ἐστὶ T 30 ἢ Theiler ἢ codd. 31-2 ἀναγραφῆς] ἀναστροφῆς G 32 [ἦ] del. Tarrant 33 τοὺς om. Mp

On account of these considerations, then, and others like them with which the treatises of the ancient writers are filled, *logos* is always associated with the form and the cause.

| Perception, on the other hand, is associated with matter and that which is affected, for the reasons we have given; but this is psychic matter, since all things of lower status are immediately matter for those that are superior.³⁹ It is in some such sense that people speak of ‘material intelligence’ (*hylikos nous*), despite the fact that it is unmixed with bodily matter, on the grounds that in its need for the activity proper to itself it became matter for the external and supervening intelligence. If we can make clear | how our judgements are brought to completion, this will provide sufficient witness to what we have said.

When matter has been given form by the *logos* of which we have spoken,⁴⁰ the soul pays attention to the things that exist⁴¹ and draws the forms out again, as it were, from the matter, receiving them into itself, and in a certain sense separating them off to make the judgement non-material. The first stage is that from sense-perception (*aisthēsis*) there arises | apprehension (*antilēpsis*), which after laying its touch on an existing thing, tries as it were to take up the forms and announce them and introduce them to the soul, as if it were a kind of guide or presenter. Secondly, opinion-based supposition (*doxastikē hypolēpsis*) receives what has been introduced, addressing it by name and writing it in the soul in the form of discourse (*logos*), as if on a writing-tablet that the soul contains. After this comes a third faculty, | imagination (*phantasia*), a maker of images of the characteristic features, and a genuinely painterly or sculptural faculty. It is not content with the form conveyed through naming and inscribing a record; but just as those who picture to themselves the passengers sailing into harbour work out a resemblance of them accurately, like people checking identity-tallies,⁴² the

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³⁹ ‘Immediately’, *prosechōs*, in the sense that their lower status ‘automatically’, as we might put it, makes them matter for those of higher status. The expressions ‘things of lower status’ (*ta hypobebēkota*) and ‘those that are superior’ (*ta epanabebēkota*) do not directly convey the logical or metaphysical relation of subject to supervening attribute, as one might expect; their task, notably in the writings of Simplicius, is to express the notions of subordination and superiority in a hierarchy, for instance the hierarchy of types of living being (*In Ar. De an.* vol. II, 315,26 and 31, cf. II6,21; cf. also *In Ar. Phys.* 47.19 Diels). It is curious that in all of these passages, *epanabainein* is directly associated with the adverb *prosechōs*, as in this passage of Porphyry.

⁴⁰ On the passage from here to 14.6 see especially Chase (2010).

⁴¹ In this context *ta onta*, ‘the things that exist’, are those that exist in the material domain.

⁴² A tally (*symbolon*) was a small object broken in two, one part of which was kept by each party to a contract; when fitted back together they provided proof of the parties’ identities. An alternative meaning for the phrase is ‘like people checking passenger-lists’; for *symbolon* in this sense see LSJ s.v. σύμβολον II.2. For other possibilities and further discussion see Chase (2010), 384 nn. 9–10.

- (14) ἐκλογίζονται· οὕτω καὶ αὕτη τοῦ πράγματος ἅπασαν τὴν μορφήν ἐκλογιζομένη, ὁπόταν τοῦτον τὸν τρόπον ἀκριβῶσῃ, τότε ἀπέθετο ἐν τῇ ψυχῇ τὸ εἶδος. καὶ τοῦτο ἦν ἡ ἔννοια, ἧς ἐγγενομένης τε καὶ βεβαιωθείσης ἡ τῆς ἐπιστήμης ἐγγίνεται διάθεσις, ἀφ' ἧς ὥσπερ ἀπὸ πυρὸς πηδῆσαν-
- (5) τος ἐξαφθὲν φῶς ὁ νοῦς ἀναφαίνεται οἷον περ ὄψις ἀκριβῆς εἰς τὴν προσβολὴν τὴν ἐπὶ τὸ ὄντως ὄν, [καί] διὰ μὲν τῆς ἀντιλήψεως ἀρξαμένης τῆς ψυχῆς καὶ μαθούσης τὸ ἐν τῇ ὕλῃ ἐνυπάρχον εἶδος, διὰ δὲ τῆς ὑπολήψεως, ὅτι τοῦτ' ἐστὶν ταῦτό τῳ δείξαντι τὸ δειχθὲν παραδεξαμένης· διὰ δὲ τῆς φαντασίας ὅτι καὶ τοιόνδε προσεξειργασμένης κατὰ τὸν εἰκονισμόν,
- (10) ὁποῖον ἦν τὸ ἐκτός· διὰ δὲ τῆς ἐννοίας ἐπὶ τὸ καθόλου μετελθούσης εἰς τὴν αὐλον ἀπόθεσιν τοῦ εἶδους, μεθ' ἣν ἐκ τῆς ἐπιβολῆς τὸ βέβαιον προσλαβοῦσα ἡ ἐπιστήμη καθαρὸν τὸν ἔπειτα καθόλου νοῦν ἐπιβλητικὸν λαμβάνει. διὸ καὶ ὁ νοῦς γίνεται ἐκείνου, οὗ ἐπιστήμη καὶ ἔννοια τοῦ εἶδους τοῦ παρέχοντος τὴν ὅλην μορφήν τῇ ὕλῃ. καὶ ἔστι τὸ γινόμενον
- (15) τοιοῦτον, ὥσπερ ἂν εἴ τις, ἀπὸ κοίλης γλυφῆς δακτυλίου ἐναποτυπωθέντος καὶ ἐναπομαχθείσης τῆς σφραγίδος μετεώρου, πάλιν αὖθις ἀπ' ἐκείνης τυπώσειεν εἰς ἑτέραν ὕλην τὴν σφραγίδα. γίνεται γὰρ ὁμοία τῇ γλυφῇ τοῦ δακτυλίου κατὰ τὴν σφραγίδα. καὶ γὰρ ἐνταῦθα, οἷον ἀπὸ δακτυλίου, τοῦ εἶδους ἀσωμάτου καὶ ἀύλου ὑπάρχοντος, ἐπειδὴν ἀπομα-
- (20) χθῇ τῇ ὕλῃ τὸ εἶδος, ἐξ ἀσωμάτου σωματοῦται. εἴτ' αὖθις πάλιν ἀναληφθὲν τῇ ψυχῇ καθ' αὐτὸ γίνεται αὐλὸν τε καὶ ἀσώματον. καὶ ἡ μὲν κρίσις τῶν ὄντων ἐστὶν αὕτη τε καὶ τοιαύτη. ἄγεται δ' εἰς προχειρότητα τε ἐκάστω καθ' ἑαυτὸν καὶ κοινωνίαν τὴν πρὸς τοὺς πολλοὺς διὰ τῆς αἰσθήσεως, ἐκδεχομένης τῆς φωνῆς τῇ διαρθρώσει τῆς λέξεως τὴν τῆς
- (25) ψυχῆς εἰκόνα καὶ ὥσπερ ἐφαρμοζούσης τοῖς τ' ἀρχετύποις αὐτοῖς εἶδεσι καὶ τοῖς τούτων μετασχοῦσιν ἐν τῇ ὕλῃ· καὶ οὕτω πάλιν καθάπερ εἰς

6 [καί] om. **m** delevit Theiler
12 ἐπιβλητικόν] ἐπιβλητικῶς Tarrant

7 δέ om. **g** 8 ταυτό] αὐτό **g** παραδειξαμένης **g**
18 τοῦ] τούτου **G**

imagination works out the thing's entire profile;⁴³ and when it has achieved this accurately in this manner, it stows the form away in the soul.

This form is the concept (*ennoia*); and when it has been implanted and firmly established, the condition of knowledge (*epistēmē*) comes into being within us. Out of this, like a light ignited from a leaping fire, | intelligence (*nous*) springs up into view, like accurate vision, as the means of approach to true reality. Thus when the soul has made a beginning through apprehension (*antilepsis*) and has discovered the form that exists in the matter; when it then has accepted, through the faculty of supposition (*hypolēpsis*), that the form displayed is the same as that of the thing that displayed it; when it has thoroughly worked out, through imagination (*phantasia*), that it is of the same kind in the image | as it was in the external object; and when, through the conception (*ennoia*), it has reached the universal, to make possible the non-material storage of the form; then, after this, knowledge (*epistēmē*), having grasped in addition secure confirmation through direct cognition (*epibolē*), receives also the intelligence (*nous*) that is directly cognitive (*epiblētikos*), in its pure and universal guise. Thus there is intelligence of that of which there is knowledge and conception, that is, of the form which gives the matter its complete profile.⁴⁴

What happens is | like this. It is as if, when a seal has received, in relief, the stamp and impression of the hollowed-out design incised on a ring, someone again stamped the impression from the seal into a different piece of matter. This, based on the seal, will be like the incised design of the ring. For in that case too, as when the impression comes from the ring, the form is bodiless and without matter; and when the form is impressed | on matter it becomes embodied instead of bodiless. Then again, when it is taken up by the soul, in itself it becomes matter-less and bodiless.

Judgement of the things that exist is of just the same sort; it is like this. It is made accessible to each individual in himself and communicable to the multitude through perception, when the voice takes up the image in the soul to articulate it in speech, | and as it were attunes it to the archetypal forms themselves and to the things that participate in them in

⁴³ 'Profile' is an attempt to convey the sense of the Greek *morphē*, here and again at 14.14 below. The noun usually refers to a thing's visible shape or appearance, and that would fit the context up to this point. But then the transition to the (non-perceptible) 'form', *eidos*, in the next part of the sentence becomes mysterious, and the problem is exacerbated at the beginning of the next paragraph by the identification of this form with a 'conception'. I suspect that the noun *morphē* is being used in a rather indeterminate way, to refer to the thing's salient characteristics (hence 'profile'), without specifying whether it is grasped in a quasi-perceptual or a more abstract manner. The vagueness of the term's use, on this interpretation, may be a symptom of more fundamental difficulties in Porphyry's treatment of *phantasia*; see Introduction pp. 19–20.

⁴⁴ On this paragraph see Chase (2010): 396–9.

αἰσθητὸν εἶδος ἐκ νοητοῦ ἄγεται τὸ τῶν ὄντων εἰκόνισμα δι' ἀκοῆς, ὥσπερ ἂν καὶ δι' ὄψεως, ἐπειδὴν αὐτὴν τις τὴν λέξιν ἀναγράφῃ.

- Διὰ μὲν δὴ τούτων σαφὲς γέγονεν, πῶς κριτήρια λέγοντες τὸν λόγον
- (30) καὶ τὴν αἴσθησιν τῶν αἰσθητῶν τὴν μὲν αἴσθησιν παρὰ τὴν ὕλην καὶ τὸ πάθος κρίνειν ἐτίθεντο, τὸν δὲ λόγον παρὰ τὸ εἶδος καὶ τὸ αἴτιον. ὑλικὸν μὲν γὰρ κριτήριον καὶ παθητικὸν ἢ αἴσθησις, εἰδικὸν δὲ καὶ ὡς ὅθεν ἢ κίνησις καὶ τὸ εἶναι αἴτιον ὁ λόγος. ὅθεν ἢ μὲν τῷ πάσχειν κρίνουσα καὶ ὑλικῶς ὀλοσχερῶς καὶ ἐς ὅσον ἂν τὸ αἰσθητὸν τυπώσῃ
- (15) καταλαμβάνει καὶ τοῦτο μόνον μηνύει, ὁ δὲ τῷ ἐνεργεῖν εἰδητικῶς καὶ ἀύλως προειληφῶς εὐρίσκεται ἅπαν τὸ κρινόμενον καὶ οἶον ἔχων τὸ εἶδος παρ' ἑαυτῷ ἀκριβῶς τοῦ ζητουμένου καὶ ἀκριβέστερόν γε ἢ ἐν τοῖς αἰσθητοῖς θεωρεῖται. ὅθεν καὶ τὸ ἐκλείπον αὐτοῦ προστίθῃσιν ὁ
- (5) λόγος καὶ τὸ ἡμαρτημένον εὐθύνει. οὐκ ἂν δὲ ταῦτα ποιεῖν μὴ προέχων ἡδύνατο. διὸ καλῶς ὁ μουσικὸς τῇ μὲν εἰπὼν τὸ ἀκριβὲς ἔξωθεν καὶ παρὰ τοῦ λόγου διδασθαι—καθ' ἑαυτὴν γὰρ εἶναι <τὸ> ὀλοσχερές—τῷ δὲ παρ' ἑαυτοῦ μὲν προεῖναι τὸ ἀκριβὲς, ἔξωθεν δὲ τὸ ὀλοσχερές ἀπαγγέλλεσθαι, τουτέστι παρὰ τῆς αἰσθήσεως.
- (10) Ἔοικε γὰρ κατὰ τὴν αἴσθησιν καὶ τὸν λόγον βασιλεῖ καὶ ἀγγέλῳ τῷ μὲν πάντα προειληφότι καὶ προειδóτι ἀκριβῶς καὶ ἔνδον παρ' ἑαυτῷ ἐν τοῖς οἰκείοις βασιλείοις διατρίβοντι, τῷ δὲ μόνον τοὺς τύπους ἀναλαμβάνειν δυναμένῳ τῶν προσειρόντων καὶ τούτους εἰσαγγέλλειν εἰς ὅσον ἀπετυπώσατο τῷ ἄρχοντι. καθάπερ οὖν ἐπὶ τούτων τοῦ ἀγγέλου ὀλοσχε-
- (15) ρῶς τοὺς τύπους τῶν ὁραθέντων μηνύοντος ὁ βασιλεὺς, ἅτε προεγνωκῶς ἅπαντα, οὐ μόνον τὸ εἰσαγγελθὲν μαρθάνει, ἀλλ' εἰ καὶ ὁ ἀπαγγέλλων οὐκ ἀκριβῶς ἐδήλωσε καὶ ὅλως πᾶσαν τὴν σύστασιν τοῦ μηνυθέντος, οὕτω καὶ ἐπὶ τοῦ λόγου καὶ τῆς αἰσθήσεως ὁ λόγος πᾶσαν τὴν τῆς αἰσθήσεως ἀντίληψιν εἰδῶς εὐρίσκεται καὶ ἀκριβέστερον ἢ ἐκείνη τὰ αἰσθητὰ
- (20) μηνύειν ἡδύνατο. ἔστι μὲν οὖν ἡ αἴσθησις προτέρα τοῦ λόγου ἐν τῇ τῶν αἰσθητῶν γνῶσει, οὐ μὴν διὰ γε τοῦτο κρείσσων τοῦ λόγου κατὰ τὴν

27 ἄγεται] ἀρχεται T 28 ἀναγράφῃ Mg 29 τοῦτο Mg

1 εἰδικῶς M p. c. T 6 ἀκριβὲς Alexanderson ἀκριβῶς codd. 7 <τό> add. Alexanderson
7 ὀλοσχερές – 8 προεῖναι om. T 10 κατὰ om. g

matter. Thus, once again, the image of things that exist is brought, through hearing, into perceptible out of intelligible form, just as it is also through sight, when someone writes the words down.

These points, then, have made it clear how, when people said that reason | and perception are criteria of perceptible things, they posited that perception judges on the basis of the matter and the attribute (*pathos*), and reason on the basis of the form and the cause; for perception is a material and passively affected criterion, while reason is a formal criterion, and is the cause from which movement and being arise. Hence perception, in judging materially and by being affected, grasps its object only roughly and to the extent that the perceived thing stamps its imprint on it, and announces no more than this; whereas reason, in acting formally and non-materially, turns out to have grasped in advance the whole thing that is judged, as if it contained in itself the form of the object of enquiry, and does so more accurately than when the investigation focuses on perceptible objects. Thus reason adds what is missing from it⁴⁵ | and corrects error. But it could not do that if it did not possess it in advance. So our musical expert was right to say that perception receives accuracy from outside of itself, from reason (since its own province is what is rough and ready), while reason possesses accuracy in advance, in its own right, and receives news of the rough and ready facts from outside of itself, that is, from perception.

[15D]

| For the situation of perception and reason is like that of a king and a messenger, in that the one grasps and knows everything accurately in advance, even while passing his time indoors by himself in his own palace, while the other can only gather up impressions of the things he encounters and report them to the ruler in so far as they have been impressed upon him. In this case, when the messenger has indicated in rough outline | the impressions of the things he has seen, the king, since he knows everything in advance, does not merely learn what has been reported, but learns also whether the messenger has presented it inaccurately, and learns, in short, the whole constitution of what has been indicated to him. Just so, in the case of reason and perception, reason turns out to know the whole of perception's apprehension (*antilepsis*),⁴⁶ and can indicate the things that are perceived more accurately | than perception. Thus perception is prior to reason in its acquaintance with perceptible things, but is not as a consequence superior to reason in its judgement. Reason does not grasp

⁴⁵ Here 'it' is the object of enquiry as it is represented by perception.

⁴⁶ On *antilepsis* see n. 30 above. Here the sense seems to be that reason already has an accurate grasp on the nature of the type of item represented in the *antilepsis* that follows on from perception.

- κρίσιν. οὐ γάρ ὅσον ἐκείνη παρίστησι, τοῦτο λαμβάνει ὁ λόγος. οὕτω γάρ ἂν ἦν οὐ χρόνῳ μόνον ὕστερος ὁ λόγος τῆς αἰσθήσεως, ἀλλὰ καὶ δυνάμει. προειληφώς δὲ παρ' ἑαυτῷ τὰ πάντα προεστῶσαν καθάπερ
- (25) ἐν προθύροις ἐν τοῖς σωματικοῖς ὀργάνοις τὴν αἰσθητικὴν δύναμιν ἔχει, παρ' ἧς ὅσον ἀπαγγέλλειν ἡδύνατο λαμβάνων αὐτὸς τὸ ἀκριβὲς καθ' ἑαυτὸν εὐρίσκει ἀποτελῶν καὶ ταύτην τῇ πρὸς αὐτὸν συνουσίᾳ ἀκριβεστέραν. ἃ δὲ παριστάς καὶ ὁ Πτολεμαῖος ἐξῆς τοῖς προειρημένοις γράφει ταῦτα.

ὅτι καὶ

καθόλου τῶν μὲν αἰσθήσεων ἴδιόν ἐστι τὸ τοῦ μὲν σύνεγγυς εὐρετικόν, τοῦ δὲ ἀκριβοῦς παραδεκτικόν, τοῦ δὲ λόγου τοῦ μὲν σύνεγγυς παραδεκτικόν, τοῦ δ' ἀκριβοῦς εὐρετικόν.

- (32) Σύνεγγυς λέγεται τὸ ὀλοσχερὲς καὶ τῷ ἀκριβεῖ ἀντικείμενον, ὃ δὲ εὐρίσκειν φησὶν ἴδιον εἶναι τῆς αἰσθήσεως. ἴδιον δ' ἔφη τῶν αἰσθήσεων
- (16) τὸ ὀλοσχερὲς, ὅτι καθ' ἑαυτὰς καὶ ὅλως κατὰ τὴν ἑαυτῶν φύσιν τοιαύτας κέκτηνται τὰς ἀντιλήψεις, μὴ γάρ μοι τὰς ὑπὸ λόγου συγγυμνασθείσας, οἶαι αἱ τῶν τεχνιτῶν αἰσθήσεις, εἰς ἔλεγχον τῶν εἰρημένων παραγέτω τις. αὐτὰς δὲ καθ' ἑαυτὰς ἄνευ τῆς παρὰ τοῦ λόγου ἐπιστάσεως σκοπεῖτω καὶ ἂν περ εὐγνώμων καὶ μὴ φιλόνηκος ἦ, τῷ λεγομένῳ ὥς ἀληθεῖ ὄντι συγχωρήσει. ἴδιον οὖν τῆς μὲν αἰσθήσεως τὸ σύνεγγυς καὶ ὀλοσχερὲς καὶ μὴ ἀκριβὲς εὐρίσκειν, τὸ δ' ἀκριβὲς παραδέχεσθαι. λέγει δὲ παραδοχὴν τὴν παρ' ἄλλου δοχὴν καὶ μὴ ἀφ' ἑαυτοῦ εὐρεσιν. παρ' ἄλλου δὲ τὸ ἀκριβὲς δέχεται, τοῦ λόγου δηλονότι, ὃς τῇ ἀκριβεῖα προέστηκε τῶν αἰσθήσεων. ἔμπαλιν δὲ τοῦ λόγου ἴδιον τοῦτο τὸ μὲν ἀκριβὲς καθ' ἑαυτὸν εὐρίσκειν, τὸ δὲ σύνεγγυς καὶ ὀλοσχερὲς ἔξωθεν καὶ παρὰ τῆς αἰσθήσεως λαμβάνειν. ἕκαστον γὰρ ὃ ἔχει διδούς, ὃ μὴ ἔχει παρ'
- (10)

22 οὕτω — 23 λόγος om. T

1 ὅτι] ἔτι T 6 σύνεγγυς Wallis συγγενές codd. 7 μὴ om. T παραδέχεται T 9 τῇ ἀκριβεῖα Wifstrand τῆς ἀκριβείας codd. 10 τοῦτο τό Düring τοῦτο MEd τό τό TG 12 ἔχει^{sec.} om. Mg

only as much as perception sets in front of it, for then it would be posterior to perception not merely in time but in power as well. But having grasped everything in advance, it has the faculty of perception standing before it | in the bodily organs as if on its doorstep; it takes from perception as much as perception can report, and by itself discovers what is accurate, making perception, too, more accurate through the latter's association with it.⁴⁷ Ptolemy presents these points when he writes as follows, immediately after the passage we have discussed.⁴⁸

| . . . since in general it is characteristic of the perceptual faculties to discover what is approximate and to receive from elsewhere what is accurate, and of reason to receive what is approximate from elsewhere and to discover what is accurate. Ptol. *Harm.* 3.5–8

By 'approximate' he means 'rough and ready', the antithesis of 'accurate'; its discovery, he says, is characteristic of perception. He said that what is rough and ready is characteristic of the perceptual faculties because by themselves and in their own natures the apprehensions (*antilēpseis*) of things that they acquire are of that sort. Let no one drag in perceptions that have been trained by reason, such as those of skilled craftsmen,⁴⁹ in order to refute what has been said. Let them consider perception as such, unaided by reason, | and if they are fair-minded and not determined to quarrel, they will agree that the statement is true. It is characteristic of perception, then, to discover what is approximate and rough and ready and not accurate, and to receive what is accurate from elsewhere. By 'reception from elsewhere' he means reception from some other source, not a discovery of its own. It receives what is accurate from another source, which is obviously reason; and reason is superior in accuracy | to the perceptual faculties.

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It is characteristic of reason, conversely, to discover what is accurate by itself, and to take what is rough and ready from outside, from perception. For each of them gives what it has, and takes what it does not have from

⁴⁷ On *anamnēsis* and the relation between what reason 'knows in advance' and what it 'discovers' see Introduction p. 20–2.

⁴⁸ The passage linked by Tarrant to the work of Thrasyllus (and discussed in Section 4(a) of my Introduction) ends here. The image of the king and his messengers appears also at Plot. *Enn.* V.3.3.44–5. It has affinities (though its purport is different) with Chrysippus' famous comparison (*SVF* 879) of the soul's ruling part with a spider detecting movements in any part of the web at whose centre it sits; cf. also *SVF* 881. For further discussion see Chase (2010): 399–401.

⁴⁹ The noun *technitēs* often refers specifically to performing artists, and especially to musicians (cf. 10.22 above); very probably that is the sense intended here. Compare Speusippus fr. 75 Tarán (quoted at Sextus Empiricus *Adv. math.* VII.145–6), which uses musical examples and may have been in Porphyry's mind when he wrote this passage.

- ἐκείνου, ᾧ δίδωσι, λαμβάνει. ἔχει δ' ὁ μὲν λόγος τὸ ἀκριβές, ἡ δ' αἰσθησις τὸ ὀλοσχερές, ὥστε τὰ ἐκατέρου ἴδια ἐκάτερον ἐρανίζεται παρὰ
- (15) θατέρου πρὸς τὴν κρίσιν. ἐκ δ' ἀμφοῖν γίνεται ἡ τελεία τῶν αἰσθητῶν κρίσις τῆς μὲν αἰσθήσεως παρεχούσης τῷ λόγῳ τὴν ὀλοσχερεστέραν ἐπίγνωσιν καὶ οἷον αἶθυσμα καὶ ἀρχὴν τοῦ κρινομένου ἐνδιδούσης, τοῦ δὲ λόγου τὴν κρίσιν τελοῦντος καὶ τῇ αἰσθήσει πρὸς ἀκριβείαν πλείστην ὠφέλειαν παρέχοντος καὶ ἀμφοῖν, οὗ ἡ χρεία πρὸς τὴν κρίσιν καὶ
- (20) τῷ ἐτέρῳ θατέρου πρὸς τε τὸ ἀρξασθαι τῆς κρίσεως καὶ τὸ εἰς τέλος ταύτην ἀκριβεστάτην ἀπεργάσασθαι.

ἐπειδὴ γὰρ ὀρίζεται καὶ περαίνεται

μόνως ἢ μὲν ὕλη τῷ εἶδει, τὰ δὲ πάθη τοῖς αἰτίοις τῶν κινήσεων, καὶ ἔστι τούτων τὰ μὲν αἰσθήσεως οἰκεῖα, τὰ δὲ λόγου, παρηκολούθησεν [10] εἰκότως τὸ καὶ τὰς αἰσθητικὰς διαλήψεις ὀρίζεσθαι καὶ περαίνεσθαι ταῖς λογικαῖς, ὑποβαλλούσας μὲν πρώτας ἐκείναις τὰς ὀλοσχερεστέρον λαμβανομένας διαφορὰς ἐπὶ γε τῶν δι' αἰσθήσεως νοητῶν, προσαγομένας δὲ ὑπ' ἐκείνων ἐπὶ τὰς ἀκριβεῖς καὶ ὁμολογουμένας.

- (23) Ἡ ὕλη καθ' ἑαυτὴν ἀπειρὸς τε καὶ ἀόριστος καὶ τὰ πάθη δὲ καθ' ἑαυτὰ ἀπειρά τε καὶ ἀόριστα συμβέβηκε. τὸ μέντοι εἶδος καὶ ὀρίζει
- (25) τε καὶ περατοῖ τὴν ὕλην καὶ τὰ αἷτια τῶν κινήσεων ὀρίζει τὰ πάθη. ἐφ' ὅσον γὰρ ἂν τὸ κινεῖν κίνησι, τοσοῦτον κινεῖται τὸ κινούμενον. ἔστι δ' ἡ μὲν αἰσθησις ὑλικὸν τι καὶ παθητικόν, ὃ δὲ λόγος εἰδικόν τι καὶ αἷτιον ὥς ὅθεν ἡ κίνησις. εἰκότως οὖν καὶ αἱ αἰσθητικαὶ διαλήψεις καὶ κρίσεις καθ' ἑαυτὰς οὔσαι ἀδιόριστοι ὀρίζονται ταῖς λογικαῖς καὶ περαίνονται. εἰ δὲ τοῦτ' ἐστὶν ἀληθές, ἀνάγκη δύο θέσθαι κριτήρια ἀρμονίας, ἀκοὴν καὶ λόγον, καὶ οὐκ, ὥς ἄλλοις ἐδόκει, πρὸς οὓς ἀποτεινόμενος ἐν τούτοις πλεονάζει ὁ Πτολεμαῖος, αἷσθησιν μόνον. εἰδὼς δ' ὁ μουσικὸς λογικὰς διαλήψεις οὔσας καὶ ἄνευ αἰσθήσεων, ὅποῖαι αἱ περὶ τῶν νοητῶν
- (17) φησιν ἐπὶ τῶν αἰσθητῶν χρεῖαν εἶναι τῷ λόγῳ τῆς αἰσθήσεως καὶ τῆς παρὰ ταύτης ὑποβολῆς πρὸς τὰς διαλήψεις τὰς περὶ αὐτῶν. αἱ γὰρ αἰσθητικαὶ κρίσεις καὶ ὥς οὗτος ἔφη διαλήψεις ταῖς λογικαῖς ὀρίζονται κρίσεσι καθ' ἑαυτὰς οὔσαι ἀδιόριστοι. τοῦτο δὲ διότι ὑλικά τε καὶ
- (5) παθητικά κατὰ τὴν ἑαυτῶν ὑπάρχουσι φύσιν. ἐξηγήσατο δὲ καὶ πῶς ταῖς λογικαῖς ὀρίζονται κρίσεσιν. ὑποβάλλουσιν μὲν γὰρ αἱ αἰσθη-

14 ἐρανίζεται] δανίζεται p 18 τῇ αἰσθήσει Alexanderson τὴν αἰσθησιν codd.

6 ὑποβάλλουσιν GT p.c. ὑπολαμβάνουσι ceteri

the one to which it gives. Reason has what is accurate and perception has what is rough and ready, so that for the purpose of judgement each borrows from the other | what is characteristic of each. Out of the two together comes the complete judgement of perceptible objects, with perception presenting to reason its rather rough recognition of that which is judged, and contributing as it were an initiating spark,⁵⁰ while reason completes the judgement and provides perception with a great deal of help towards accuracy. Both of them provide, | each to the other, what is needed for the purpose of judgement, both to initiate the judgement and to work it up accurately to its completion.

For since the matter is made determinate and limited only by form, and the attribute (*pathos*) by the causes of the movements, and since of them the former [matter and attribute] belong to perception, the latter [form and cause] to reason, it will naturally follow that perceptual apprehensions are made determinate and limited by rational ones, submitting to them their initial, rather roughly grasped distinctions – at least in the case of things that are intelligible through perception – and being led by them towards distinctions that are accurate and accepted. Ptol. *Harm.* 3.8–14

Matter in itself is unlimited and indeterminate, and so are the attributes (*pathe*) in themselves. Form, however, makes the matter determinate | and limits it, and the causes of the movements make the attributes determinate. For that which is moved is moved to whatever extent the mover moves it. Perception is something material and passively affected, while reason is something formal and is the cause from which the movement arises. It is therefore natural that perceptual apprehensions and judgements, which are ill-defined in themselves, are made determinate and limited by rational ones. | And if this is true, one must posit two criteria of attunement, hearing and reason, and not perception alone as was supposed by others against whom Ptolemy directs copious criticisms in this work.⁵¹

Knowing that there are rational apprehensions even without perceptions, such as those concerning intelligible objects, the musical expert says that in the case of perceptible objects, reason needs perception and the submissions it makes to assist its own apprehensions of them. For perceptual judgements and ‘apprehensions’, as he puts it, are indeterminate in themselves but are made determinate by rational judgements. This is because the perceptual faculties, | in their own nature, are material and passive. He also explains how they are made determinate by rational judgements. The perceptual

[17D]

⁵⁰ Cf. Ptolemaï's at 23.26, 25.28.

⁵¹ This must be an allusion to the Aristoxenians, though it hardly does justice to their position; see e.g. Didymus' discussion of Aristoxenus at 27.17–28.26 below.

- τικαὶ κρίσεις τὰς ὀλοσχερέστερον λαμβανομένας διαφορὰς τῶν αἰσθη-
τῶν τῷ λόγῳ. ὁ δὲ λόγος εὐρὼν τὸ ἀκριβὲς προσάγει λοιπὸν καὶ τὰς
(10) αἰσθητικὰς κρίσεις ἐπὶ τὰς ἀκριβεῖς καὶ ὁμολογουμένας. χρεῖα γὰρ τῷ
λόγῳ τοῦ κατὰ τὴν αἴσθησιν κριτηρίου, εἰ καὶ ὀλοσχερέστερον τοῦτό
γε, ἀλλ' ἐπὶ γε τῶν δι' αἰσθήσεως νοητῶν. δι' αἰσθήσεως δὲ νοητὰ τίνα
ἐστίν, γνωσθεῖν ἄν, εἰ τὸ νοητὸν ποσαχῶς λέγεται μάθοιμεν.

- Λέγεται τοίνυν νοητὸν ἰδίως, ὃ κατ' αὐτὴν τὴν οὐσίαν διενήνοχε τῶν
αἰσθητῶν, ὥς ἔστι μόνα τὰ ἀσώματα νοητὰ καὶ καθάπαξ ὅσα μὴ σώματα.
(15) ἔλέγετο γοῦν ὁ περὶ τῶν τοιούτων παρὰ τοῖς ἀρχαίοις λόγος περὶ τῶν
νοητῶν. λέγεται ἐτέρως νοητὸν, ἐφ' ὃ δύναται ἐπίστασις γενέσθαι τοῦ
νοῦ καὶ ἀντίληψις. οὕτω δὲ καὶ τὸ αἰσθητὸν ἔσται νοητὸν καὶ ἅπαν γε.
οὐδὲ γὰρ τοῦτο τῶν ἀπλῶς λεγομένων, ἀλλ' οὔτε δύναται ἄν αἰσθήσει
γενέσθαι αἰσθητὸν καὶ προσέτι τὸ ἐκ τῆς οὐσίας ὃν τῶν αἰσθητῶν, κἂν
(20) ὑπὸ σμικρότητος παντάπασιν διαφεύγῃ τὴν αἴσθησιν. ἔτι ἰδίως νοητὸν
λέγεται τὸ πρὸς μόνην τὴν τοῦ νοῦ γνώσιν ὑφεστηκός, τὴν δ' αἴσθησιν
διαφεύγον, ὥς τὰ ὑπὸ σμικρότητος ἐκφεύγοντα τὴν αἴσθησιν νοητὰ μὲν
φαμεν εἶναι, αἰσθητὰ δ' οὔ. κείσθω οὖν νοητὸν τό τε ὅπως οὖν τῷ νῷ
(25) ποιοῦν ἀντίληψιν καὶ τὸ ἔξω τῆς τῶν αἰσθητῶν ὑπάρχον οὐσίας, καὶ οὗ
διὰ μὲν τῆς αἰσθήσεως οὐ δυνατόν, διὰ δὲ τοῦ νοῦ μόνως πεφύκαμεν
ἀντιλαμβάνεσθαι. ἄλλως δὲ τι τὸ ἤδη νοητὸν καὶ τὸ ὅσον ἐφ' ἑαυτῷ.
κατὰ δὲ τὸ δεύτερον οὖν σημαινόμενον καὶ τὰ κατὰ τοὺς φθόγγους
αἰσθητὰ ἔστι νοητὰ, ὅτι δύναται καὶ περὶ τούτων ὁ λόγος ἐπιστῆσαι, ὃν
(30) κρίσιν χρεῖα τῶν αἰσθήσεων τῷ λόγῳ, διὰ τοῦτο ταῦτα γε δι' αἰσθήσεως
νοητὰ καλεῖται.

judgements submit to reason the distinguishing features of perceptible things, which they grasp rather roughly; and reason discovers what is accurate, and additionally draws the perceptual judgements too towards distinctions that are accurate and accepted. For reason has need | of the criterion of perception, rough and ready as it is, though only in the case of things that are intelligible through perception. We can understand which things are intelligible through perception if we find out how many ways there are in which 'the intelligible' is spoken of.

What is said to be intelligible in a special sense⁵² is that which in its very essence is separate from perceptibles; in this sense only bodiless things and those which absolutely are not bodies are intelligible. | What the ancient authors say about things of that sort, at any rate, is said about the intelligibles. What is said to be intelligible in another way is that which the intelligence can observe and apprehend. In this usage what is perceptible, indeed the whole of it, will also be intelligible. For the perceptible, too, is not among the things that are spoken of in one way only, since if it were it could not be both perceptible to perception, and also that which belongs to the essence of perceptibles even when | it completely escapes perception because of its smallness. That which is subject to the recognition of intelligence alone and escapes perception is also spoken of as intelligible exclusively, as when we say that things which escape perception because of their smallness are intelligible but not perceptible. Let us specify as intelligible, then, both that which in any way allows the intelligence to apprehend it and exists outside the realm of perceptibles, and that which | it is not possible to apprehend through perception, but which our nature equips us to grasp through intelligence alone.⁵³ (Another distinction is between that which is already known by the intelligence and that which in itself is intelligible.⁵⁴)

In the second of these senses,⁵⁵ what is perceptible in connection with musical notes is also intelligible, since knowledge of such things can also be gained by reason (*logos*), which the ancient writers also quite commonly called 'intelligence' (*nous*). It is because reason | has need of the perceptual faculties to assist in the judgement of these things that they are called 'intelligible through perception'.

⁵² 'In a special sense' renders *idiōs* (I owe this way of translating it to an anonymous reader). Porphyry's point is that such things are intelligible *and not also perceptible*, as becomes clear below. *Idiōs* is thus to be distinguished from *kuriōs*, which means 'in the primary sense' or 'strictly speaking'.

⁵³ Where I have used the verb 'to apprehend' in this sentence and at 17.17 above, Porphyry uses either the noun *antilepsis* or the verb cognate with it. See n. 30 above.

⁵⁴ This reflects an ambiguity in the adjective *noētos*, which can mean either 'known through intelligence' or 'knowable through intelligence', 'intelligible'.

⁵⁵ That is, the second of the senses mentioned at the beginning of this discussion, 'that which the intelligence can observe and grasp'.

τοῦτο δὲ ὅτι τὸν

μὲν λόγον συμβέβηκεν ἀπλοῦν τε εἶναι καὶ ἀμιγῇ, διὰ τοῦτο δὲ αὐτοτελῇ [15]
καὶ τεταγμένον καὶ αἰετὸς πρὸς τὰ αὐτὰ ὡσαύτως ἔχοντα, τὴν δὲ αἴσθησιν
μεθ' ὕλης πάντοτε πολυμιγοῦς τε καὶ ρευστῆς, ὥστε διὰ τὸ ταύτης
ἄστατον μῆτε τὴν πάντων, μῆτε τὴν τῶν αὐτῶν αἰετὸς πρὸς τὰ ὁμοίως
ὑποκείμενα τηρεῖσθαι τὴν αὐτήν, ἀλλὰ δεῖσθαι καθάπερ τινὸς βακτηρίας
τῆς ἐκ τοῦ λόγου παραπαιδαγωγήσεως. [20]

- (18) Ἄυλον γὰρ τὸν λόγον ὄντα καὶ οἱ παλαιοὶ ἀπλοῦν ἔφασκον εἶναι καὶ
ἀνεμπόδιον καθ' ἑαυτὸν πρὸς τὰς ἐνεργείας διὰ τοῦτο. διὸ καὶ τῆς
ἀληθείας ὁ λόγος μέτοχος καὶ τοῦ ἀκριβοῦς εὐρετικός. ἀπλοῦν γὰρ ἡ
ἀλήθεια καὶ καθαρὸν, τὸ δὲ ψεῦδος τούναντίον. πρὸς δὲ τούτοις ἡ μὲν
(5) ἀλήθεια βέβαιον καὶ ὁμοιον καὶ μονοειδές, τὸ δὲ ψεῦδος ἀνόμοιον καὶ
ἀβέβαιον καὶ πολυφάνταστον, ὁ δὲ λόγος βέβαιόν τε καὶ ὁμοιον καὶ
μονοειδές, ἡ δ' αἴσθησις τὰ ἐναντία. ὁ μὲν ἄρα τῇ ἀληθείᾳ συγγενής, ἡ
δὲ τοῦ ψεύδους μέτοχος. ἔστι γὰρ ἡ μὲν ὕλη σύμπλοκος, ἡ τῆς ἀγνοίας
ἦν αἰτία, αὐτὴ τε ἄστατος καὶ αἰετὸς φερομένη. εἰκότως οὖν τὸ ἀκριβές
(10) ἔλεῖν καθ' ἑαυτὴν οὐκ οἶα τε. ὁ δὲ λόγος ἄυλος ὧν αὐτοτελής ἐστι,
τοῦτο δ' ἐστὶν αὐτάρκης ἑαυτῷ εὐρίσκειν τὸ οἰκεῖον τέλος· αὐτοκίνητος
γὰρ. ἡ δ' αἴσθησις μεθ' ὕλης πάντοτε πολυμιγοῦς τε καὶ ρευστῆς· διὸ
πρὸς τὰ αὐτὰ ὑποκείμενα οὐχ ὁμοίως φέρεται, οὔτε ἡ πάντων αἴσθησις
—ἄλλως γὰρ ἄλλος περὶ τὸ αὐτὸ κινεῖται, ὁ μὲν ὀλοσχερέστερον, ὁ δὲ
(15) τι τούτου ἀμβλύτερον—οὔτε τῶν αὐτῶν αἰετὸς ἐν τοῖς αὐτοῖς ὁμοίως. ὁ
γὰρ αὐτὸς ἄλλοτε ἄλλως περὶ ταύτου κρίνει κατ' αἴσθησιν. τὸ δὲ “ταύ-
της ἄστατον” ἀκουστέον ἐπὶ τῆς ὕλης καὶ τὸ “μῆτε τὴν πάντων” ἀκου-
στέον αἴσθησιν. καὶ πάλιν “μῆτε τῶν αὐτῶν αἰετὸς” ἀκουστέον αἴσθησιν.
τί οὖν ἦ τε τῶν πάντων αἴσθησις καὶ ἡ τῶν αὐτῶν αἴσθησις πέπονθεν,
(20) ἐπάγει· πρὸς τὰ ὁμοίως ὑποκείμενα οὐ τηρεῖται ἡ αὐτὴ διὰ τὸ τῆς
ὕλης ἄστατον, ἀλλὰ δεῖται τῆς παρὰ τοῦ λόγου βοηθείας καθάπερ οἱ
στῆναι καθ' ἑαυτοὺς μὴ δυνάμενοι βάκτρον. ὁ γὰρ λόγος πρὸς τὰ αὐτὰ
ὡσαύτως ἔχει καὶ τὸ ἐπαγόμενον δὲ παράδειγμα συνίστησι τὸ ὁμοιον.

in lemmate: 3.17 ὥστε] ὡς ME 18 τὴν^{prim.}] πάντη ME τὴν^{sec.} om ME 20 τῆς ἐκ τῆς
λόγου M

3 ἡ om. M 4 τὸ δὲ ψεῦδος — 5 μονοειδές om. G 5 καὶ ὁμοιον — 6 ἀβέβαιον om. T 8 ὕλη
scripsi ὕλη codd. 17 ἐπὶ] περὶ G 19 ἡ τε scripsi anonymum lectorem secutus ἦτε Düring
19 καὶ ἡ — 20 ὑποκείμενα om. Mg καὶ ἡ τῶν αὐτῶν αἴσθησις om. T

This is because reason is simple and unmixed, and is therefore autonomous and fixed, and always the same in relation to the same things; whereas perception is involved with perpetually mixed and fluctuating matter, so that because of its instability neither that of everyone nor that of the same people always remains the same in relation to objects of the same sort, but it needs as it were a crutch, that provided by the additional teaching of reason. Ptol. *Harm.* 3.14–20

Since reason is without matter, the ancient authors too asserted that it is simple and therefore, in itself, unimpeded in its activities. This is why reason participates in truth and discovers what is accurate. For truth is something simple and pure, while falsehood is the opposite. Truth, in addition, | is something secure and consistent and single in form, whereas falsehood is inconsistent and insecure and takes many guises; and reason is something secure and consistent and single in form, while perception is the opposite. Reason, then, is akin to truth, while perception participates in falsehood. For perception is entwined with matter, which is the cause of ignorance, and in itself is unstable and always shifting. Unsurprisingly, then, it is | incapable of grasping by itself what is accurate. But since reason is without matter it is autonomous, that is, it is self-sufficient for making the discovery which is its proper goal; for it is self-moved.⁵⁶ But perception is involved with perpetually mixed and fluctuating matter. Hence it is not moved consistently in the same way in relation to the same objects, and neither everyone's perception – since different people are moved differently by the same thing, one | grasping it in rough outline but another more dimly – nor that of the same people is always the same in the same circumstances. For the same person on different occasions judges differently about the same thing on the basis of perception. 'Its instability' is to be understood as referring to matter, and 'neither that of everyone' as referring to perception, as also is 'nor that of the same people always'. He goes on to explain what happens to everyone's perception and to the perception of the same people. | It does not remain the same in relation to objects of the same sort because of the instability of matter, but needs the help of reason just as those who cannot stand by themselves need a stick. For reason stays the same in relation to the same things, and the example which he introduces establishes what it is like.⁵⁷

[18D]

⁵⁶ Cf. Introduction pp. 21–2.

⁵⁷ My thanks to an anonymous reader for correcting my translation of the last clause (from 'and the example').

ὥσπερ οὖν ὁ μόνη τῇ ὤφει [20]

[4] περιενεχθεὶς κύκλος ἀκριβῶς ἔχειν ἔδοξε πολλάκις ἕως ἂν ὁ τῷ λόγῳ ποιηθεὶς εἰς ἐπίγνωσιν αὐτὴν μεταγάγοι τοῦ τῷ ὄντι ἀκριβοῦς, οὕτω καὶ μόνη τῇ ἀκοῇ ληφθῇ τις ὠρισμένη διαφορὰ ψόφων, δόξει μὲν εὐθύς ἐνίοτε μῆτε ἐνδεῖν τοῦ μετρίου, μῆτε ὑπερβάλλειν, ἐφαρμοσθείσης δὲ τῆς κατὰ τὸν οἰκεῖον λόγον ἐκλαμβανομένης ἀπελεγχθήσεται πολλάκις [5] οὐχ οὕτως ἔχουσα, τῆς ἀκοῆς ἐπιγινωσκούσης τῇ παραθέσει τὴν ἀκριβε-
στέραν ὥσανεὶ γνησίαν τινὰ παρ' ἐκείνην νόθον. ἐπειδὴ καὶ καθόλου τὸ κρῖναι τι τοῦ ποιῆσαι τὸ αὐτὸ ῥᾶον, οἷον πάλαισιν τοῦ παλαῖσαι καὶ ὀρχησιν τοῦ ὀρχήσασθαι καὶ αὐλησιν τοῦ αὐλῆσαι καὶ ἄσιν τοῦ ἄσαι,

- (25) Μόνη τῇ ὤφει περιάγεται κύκλος ὁ καταγραφόμενος ἄνευ διαβήτου πρὸς τὸ δοκοῦν τῇ ὤφει εἶναι περιφερές· διὸ οὕτω περιενεχθεὶς δοκεῖ μὲν εἶναι ἀκριβὴς τῇ αἰσθήσει, ἀλλ' ὅταν ὁ λόγῳ περιενεχθεὶς, τουτέστιν ὁ τῷ ἀκριβεῖ διαβήτη ἀποτελεσθεὶς παρατεθῇ, ἀφίσταται μὲν ἢ αἰσθησις τοῦ προτέρου αὐτῶν καὶ ἀλλοτρίου, προσίεται δὲ τὸν ὑπὸ τοῦ
- (30) λόγου εὐρεθέντα ὡς τῷ ὄντι τοῦτον ὄντα τὸν κύκλον, ἐκείνον δ' οὐ. ὡς τοίνυν ἐπὶ τῶν κατὰ τὴν ὄρασιν ἔχει, οὕτω καὶ ἐπὶ τῶν ψόφων τῶν κατὰ
- (19) τὴν ἀκοήν. διαφέρουσι μὲν γὰρ ἀλλήλων οἱ ψόφοι βαρύτητι καὶ ὀξύτητι. τὰς δὲ συμμετρίας τῶν βαρυτήτων καὶ τῶν ὀξύτητων ταχέως καὶ ὁλοσχερῶς καθ' ἑαυτὴν κρίνει ἡ ἀκοή. τοῦτο δ' οὐ γινώσκει, ἀλλ' οἶεται εἶναι τὸ ἀκριβές. ὅταν δ' ἡ κατὰ τοὺς ψόφους συμμετρία κατὰ τὸν
- (5) λόγον ἀφορισθῇ, ἐλέγχεται μὲν τὸ δοκοῦν εἶναι ἀκριβές τῶς κατὰ τὴν αἰσθησιν. μετατίθεται δ' ἡ αἰσθησις πρὸς τὸ ἀφορισθὲν ὑπὸ τοῦ λόγου ὡς ἐπ' οἰκεῖον αἰσθητόν. ὁ μὲν οὖν εὐρίσκων τὸ ὀρθὸν καὶ ἀκριβές ἦν ὁ λόγος, τὸ δὲ κρίνον τὸ εὐρεθὲν ὑπὸ τοῦ λόγου ἢ αἰσθησις. πανταχοῦ δ' ἐπὶ ταύτου τὸ κρῖναι τοῦ ποιῆσαι ῥᾶον, οἷον τὸ κρῖναι πάλαισιν τοῦ παλαῖσαι ῥᾶον καὶ τὸ κρῖναι ὀρχησιν τοῦ ὀρχήσασθαι εὐμαρέστερον. οὕτως οὖν καὶ τὸ εὐρεῖν τὸ ἡρμοσμένον καὶ ἀφορίσαι τὰς τῶν ψόφων διαφόρους συμμετρίας τοῦ κρῖναι δυσκολώτερον. ποιεῖ τοίνυν ὁ λόγος, κρίνει δ' ἡ αἰσθησις ἢ τοιαύτη τὸ σύμμετρον. ἐπιστήσαι δ'
- (10)

27 λόγῳ T p. c. m. a. λόγος ceteri 29 αὐτῶν] αὐτόν m

in lemmate: 4.2 ἀκριβῶς m

2 ταχέως] παχέως g 7 ἐπ' οἰκείων αἰσθητῶν T 9 οἷον — 10 ῥᾶον om. T

Thus just as a circle drawn by sight alone often appears to be accurate, until the circle formed by reason (*logos*) brings the sight to recognise the one that is really accurate, so if some specific difference between sounds is constructed by hearing alone, it will sometimes seem at first neither to fall short of what is proper nor to exceed it, but when the one constructed according to the appropriate ratio (*logos*) is tuned alongside it, it will often be proved not to be so, as the hearing recognises through the comparison the legitimacy of the more accurate beside the bastardy of the other; for in general it is easier to judge something than to make the same thing, as for instance to judge wrestling than to wrestle, to judge dancing than to dance, to judge pipe-playing than to play the pipes and to judge singing than to sing. Ptol. *Harm.* 3.20–4.9

| A circle drawn around by sight alone is one which is inscribed without the compasses, to make it appear circular to the sight. Hence one drawn in this way appears accurate to perception. But when one drawn by reason, that is, one accomplished with an accurate pair of compasses, is placed alongside it, perception deserts the former of them, which is inappropriate, and goes over to the one | discovered by reason, on the grounds that the latter is really a circle and the former is not. As it is with things assessed by sight, so it is with sounds assessed by hearing. Sounds differ from one another in respect of high and low pitch. Hearing by itself judges the proportional relations between depths and heights of pitch quickly and roughly; and it does not know that this is accurate, but it thinks it is. But whenever the proportional relation between sounds is | determined according to reason,⁵⁸ the one that until then appears accurate according to perception is refuted. Perception transfers its allegiance to the one determined by reason as being the appropriate perceptible object. Thus that which discovers what is correct and determines what is accurate is reason, and that which judges what has been discovered by reason is perception.

[19D]

In all cases, judging something is easier than making the same thing, as for instance it is easier to judge | wrestling than to wrestle and simpler to judge dancing than to dance. Correspondingly, therefore, it is more difficult to discover that which is attuned and to determine the various proportional relations between sounds than to judge them. Thus reason makes what is proportional, and this kind of perception judges it.⁵⁹ One might object

⁵⁸ One could in principle read this phrase as meaning ‘in accordance with the ratio’, and Porphyry no doubt intended to recall that sense of *logos* to his readers’ mind. But the primary reference must be to reason, if the flow of the argument is not to be disrupted. So too with the reference to ‘reason’ in the next sentence.

⁵⁹ Porphyry correctly extracts the import of Ptolemy’s remarks, though he goes beyond what is directly conveyed in the lemma. In Ptolemy’s musical examples the counterparts of judging are instances of performing. Here, however, what is judged is not a musical performance but an estimate of what is well attuned and exemplifies properly ‘proportional’ relations between sounds. The discovery of

- (15) ἄν τις, μή ὁ καὶ εὐρίσκων καὶ κρίνων ὁ λόγος ἢ τὸ ἡρμοσμένον· οὐκ ἄνευ μέντοι τῆς αἰσθήσεως. ὄργανον γὰρ τοῦ λόγου ἡ αἴσθησις. ὥς οὖν ἄνευ πρίονος οὐκ ἂν πρίσαι ὁ τέκτων, οὐ μέντοι διὰ τοῦτο τοῦ πρίονος τὸ πρίζειν ἐνέργημα, ἀλλὰ τοῦ τέκτονος διὰ τοῦ πρίονος· οὕτω μή ποτε ἄνευ αἰσθήσεως οὐκ ἂν κριθεῖη τὸ ἡρμοσμένον. οὐ μέντοι τῆς αἰσθήσεως ἂν εἴη τὸ κρίνειν, ἀλλὰ τοῦ λόγου διὰ τῆς αἰσθήσεως.

καὶ τοίνυν ἡ τοιαύτη τῶν αἰσθήσεων ἔνδεια πρὸς μὲν τὸ γνωρίσαι τὸ [10] διάφορον ἀπλῶς ἢ τὸ μή πρὸς αὐτάς, οὐ παραπολύ ἂν διαμαρτάνοι τῆς ἀληθείας, οὐδ' αὖ πρὸς τὸ θεωρῆσαι τὰς τῶν διαφερόντων ὑπεροχὰς τὰς γοῦν ἐν μείζοσι μέρεσιν ὧν εἰσι λαμβανομένας. ἐπὶ δὲ τῶν κατὰ ἐλάττονα μόρια παραβολῶν πλείων ἂν συνάγοιτο καὶ ἤδη κατάφωρος αὐταῖς καὶ μᾶλλον ἐπὶ τῶν μᾶλλον λεπτομερεστέρων. [15]

- (21) Τὸ γὰρ δὴ μή εἰς τὸ ἀκριβὲς ἐξικνούμενον τῶν αἰσθήσεων καὶ ἡ τοιαύτη αὐτῶν ἔνδεια πρὸς μὲν τὸ γνωρίσαι ἀπλῶς, τουτέστι μή ἀκριβῶς ἀλλ' ὀλοσχερῶς, τὸ διάφορον <ἦ> μή διάφορον τῶν πρὸς αὐτῶν κρινομένων οὐκ ἂν πάνυ διαμάρτοι, οὐδὲ κατάφωρος αὐταῖς ἡ οἰκεία ἔνδεια ἐπὶ τούτων γίνεται. οὐδὲ μὴν αἱ μεγάλαι ὑπεροχαὶ τῶν διαφερόντων πάρει-
- (25)

14 μή καὶ ὁ G ὁ^{sec.} om. m 18 ante κριθεῖη add. μή mp 23 <ἦ> add. Düring μή διάφορον om. p 24 διαμαρτάνοι G κατάφορος G

in lemmate: 4.11 post μή add. διαφέρον MEG

that reason both discovers and judges that which is attuned; but | it does not do so without perception. For perception is an instrument of reason. Just as the carpenter cannot saw without a saw, but sawing is not therefore an activity of the saw but of the carpenter by means of the saw, so what is attuned could never be judged without perception. Judging, however, is not an activity of perception, but of reason by means of perception.⁶⁰

| Now this sort of deficiency in perceptions will not miss the truth by much when the task is to recognise in their objects simply what differs and what does not, nor when it is to identify the amounts by which differing things exceed one another, so long as these amounts consist in larger parts of the things whose parts they are. But in juxtapositions⁶¹ involving smaller parts the deficiency will accumulate and will now be detected in them, the more so as the things are divided into slenderer parts. Ptol. *Harm.* 4.10–15

The failure of perceptions to reach accuracy, and this sort of deficiency in them, will not go badly wrong in recognising simply – that is, not accurately but in rough outline – what differs and what does not among the things judged by the perceptions, nor will their characteristic deficiency be detected | in these cases. Nor indeed do large excesses⁶² between differing

such structures is conceived as a mode of ‘making’, since it involves the intellectual construction of a system of musically appropriate relations.

⁶⁰ It seems impossible to make these statements strictly consistent with Porphyry’s previous assertions, ‘that which judges what has been discovered by reason is perception’ and ‘this kind of perception judges it’. I take it that the later claims are designed to modify and in effect to replace the earlier ones; cf. 151.9–16 below.

⁶¹ ‘Juxtaposition’ represents the etymological sense of the Greek *parabolē*, which is commonly used to mean no more than ‘comparison’. I use ‘juxtaposition’ here partly because Porphyry’s discussion of the passage exploits this meaning, and partly because it reflects the character of the process of comparison that Ptolemy is envisaging. We compare the lengths of two lines, and divide a line or multiply its length, by imaginatively placing one line or line-segment against the other. See Porphyry’s comments on Ptol. 4.19–5.2 below.

⁶² ‘Excesses’ is a literal translation of *hyperochai*; a *hyperochē* is that by which larger things ‘exceed’ (*hyperochēin*) smaller ones. The verb and especially the noun play important roles in Ptolemy’s work, and Porphyry follows his lead; in fact he uses them much more often than Ptolemy does in the chapters that the commentary discusses. ‘Excess’ in these contexts often reads awkwardly in English, and in many cases the translation ‘difference’ would be more natural. But in the first place it disguises the fact that *hyperochē* is a different word from *diaphora*, the regular word for ‘difference’; and secondly, the noun *hyperochē* acquires several distinct meanings in the course of the text, sometimes within a single passage, and it is important to keep track of the confusing ways in which the discussion slips between them. I have therefore chosen to mark the appearances of *hyperochē* by retaining the same translation, ‘excess’, wherever it occurs, despite its frequent linguistic awkwardness. In its commonest usage in Porphyry’s text, as in Ptolemy’s (we might call it their ‘official’ usage), a *hyperochē* is not conceived as an absolute amount, but through the relation in which it stands to one or both of the things compared, usually the smaller of them. Thus the appropriate way of specifying the *hyperochē* by which 12 exceeds 8 is not to say that it is 4, but that it is half the smaller term (from which it immediately follows that it is one third of the greater). In most cases (but not all) where it is represented as an absolute quantity, or where it is not the ‘excess’ of one term of a ratio over the other, the views of other theorists are under scrutiny, and Porphyry’s uses of *hyperochē* in his comments usually (but not always) reflect their treatment of the term.

- σιν αὐταῖς. κατάφωροι δ' αὐταῖς γίνονται διὰ τὸ παρηλλαγμένον τοῦ μεγέθους, ὅθεν ἐν τούτοις ἀνεπίστατον αὐταῖς τὸ οἰκεῖον ἐνδεές. ἐπὶ δὲ τῶν ὀλίγων διαφερόντων πλείων ἂν γένοιτο αὐταῖς ἢ διαμαρτία τῷ μὴ ἐξιχνεῖσθαι αὐτοῦ. καὶ ἤδη ἡ οἰκεία αὐτῶν ἔνδεια ἐν τούτοις κατάφωρος καὶ μᾶλλον ἐπὶ τῶν μᾶλλον λεπτομερεστέρων. αὐτίκα καὶ ἐν τοῖς πολυανθρωποτάτοις θεάτροις, ἃ συμπληροῖ παντοδαπὸς καὶ ἄμουσος
- (30) ὄχλος, ἔστιν ἰδεῖν θορυβοῦντας, ὅταν αὐλητῆς ἀσύμφωνον ἐμπνεύσῃ μὴ πιέσας τὸ στόμα θρυλισμὸν ἢ ἐκμελές τι αὐλήσῃ, καὶ ὅταν τις ἐν ῥυθμοῖς κροῦσιν ἢ κίνησιν ἢ φωνὴν ἐν ἀσυμμέτροις ποιήσῃται χρόνοις· τὰς μέντοι μικρὰς παραλλαγὰς οὐκ ἂν ἡ τούτων ἐπικρίνειεν αἴσθησις. οὕτω
- (5) τὸ μὲν ἀπλῶς καὶ παχὺ πάσης ἦν ἐπιγνώναι αἰσθήσεως ἐν τε ταῖς διαμαρτίαις καὶ ταῖς κατορθώσεσι, τὸ δ' ἀκριβές ἐπὶ τούτων καὶ κατὰ μικρὸν [καί] παρηλλαγμένον οὐκέτ' ἦν ῥᾶδιον ταῖς αἰσθήσεσιν ἀφορίζειν. αἰτιολογῶν δὲ τὸ συμβαῖνον ὁ μουσικὸς ἐπάγει.

αἴτιον δὲ ὅτι τὸ [15]

παρὰ τὴν ἀλήθειαν καθάπαξ βραχύτατον ὃν ἐν μὲν ταῖς ὀλιγάκις γινόμεναις παραβολαῖς οὐδέπω τὴν ἐπισυναγωγὴν τοῦ βραχείος αἰσθητὴν δύναται ποιεῖν, ἐν δὲ ταῖς πλεονάκις ἀξιόλογον ἤδη καὶ παντάπασιν εὐκατανόητον.

- (10) Ὡντως γὰρ τὸ μὲν ψεῦδος οὐ μόνον παρὰ τὴν μεγάλην παραγωγὴν, ἀλλὰ καὶ παρὰ τὴν τυχοῦσαν συνίσταται. ἀκρότητος γὰρ λόγον ἐπέχον τὸ ἀληθές πᾶν τὸ μὴ τοιοῦτον ἐσφαλμένον ἀποφαίνει. ἡ δ' αἴσθησις τὴν μὲν μικρὰν παραλλαγὴν καταλαμβάνειν οὐχ οἷα τε διὰ τὸ πᾶν αὐτὴν τὸ μικρὸν αὖ διαλανθάνειν, τὴν δὲ μεγάλην οἷα τε. γινομένης οὖν οὐ μόνον
- (15) παρὰ τὴν μεγάλην παραλλαγὴν τῆς ἁμαρτίας, ἀλλὰ καὶ παρὰ τὴν μικρὰν, οὐχ οἷα τε οὕσα τὴν μικρὰν καταλαμβάνειν, ἢ αἴσθησις ἀπατᾶται ἐν τούτοις.

εὐθείας γοῦν δοθείσης ἐλάττονα μὲν αὐτῆς ἢ μείζονα

λαβεῖν τῇ ὅψει προχειρότατον, οὐχ ὅτι μόνον ἐν πλάτει τὸ τοιοῦτον, [20] ἀλλ' ὅτι καὶ ἡ παραβολὴ μία. καὶ δίχα τεμεῖν ἢ διπλασιάσαι πρόχειρον ἔτι κἂν μὴ ὁμοίως δύο μόνων γινομένων τῶν παραβολῶν. τὸ τρίτον δὲ ἢ λαβεῖν ἢ τριπλασίαν θεῖναι χαλεπώτερον, τριῶν ἤδη συνισταμένων ἐνταῦθα τῶν ἁρμογῶν, καὶ κατὰ λόγον αἰεὶ δυσεφικτότερον ἐπὶ τῶν ἐπὶ πλείοσι καταμετρήσεσι θεωρουμένων, ὅταν αὐτὸ καθ' αὐτὸ τὸ ἐπιζητού- [25]

26 κατάφωροι G 28 πλείων T 29—30 κατάφωρος G 31 θεάτροις οἱ. T

10 ὄντως] οὕτως p 16 ἀπατᾶται ἐν τούτοις οἱ. T

things pass them by; perceptions are detected in error through discrepancies in the size, and so in cases like these their characteristic deficiency passes unnoticed. But their error becomes greater when they address things that differ by a small amount, since they have no access to it. In these cases, then, their characteristic deficiency | is detected, and the more so as the things are divided into slenderer parts. In the most crowded theatres, for instance, packed full with a motley and uneducated mob, one can see them breaking into uproar whenever a piper fails to compress his lips and blows a cracked and discordant note or plays something out of tune, and whenever someone in their rhythms makes an instrumental sound, a movement or a vocal sound in ill-proportioned time-lengths; but such people's perception cannot distinguish small discrepancies. Thus | it is within the capacity of all perception to recognise what is straightforwardly and broadly the case, both when things have gone wrong and when they are correct, but perceptions cannot readily distinguish what is accurate in these cases from what deviates from it just a little. As he continues, our musical expert gives an account of the reason⁶³ why this is so.

[20D]

The reason is that the deviation from truth, which is very slight when taken just once, cannot yet make the accumulation of small amounts perceptible when only a few juxtapositions are made, but when more have been made it becomes obvious and altogether easy to detect. Ptol. Harm. 4.15–19

| Falsehood really resides not only in large errors but in any error whatever; for truth, which is to be defined as an extreme (*akrotēs*), displays everything which is not of that sort as mistaken. But perception is unable to grasp a small error, since everything small escapes it, whereas it can grasp a large one. Thus since a mistake has been made not only | when the error is large but also when it is small, and since perception cannot grasp a small one, in these latter cases it is deceived.

Thus given a straight line it is very easy to construct a smaller or a greater than it by eye, not just because this is a broad sort of distinction, but because it also involves only one juxtaposition. Dividing it in half, too, or doubling it is still easy, if not to the same extent, since only two comparisons take place. To construct a third of it or to triple it is harder, since in this case three collocations⁶⁴ are made, and it becomes continually and proportionately harder to achieve in the case of things assessed through greater numbers

⁶³ 'Gives an account of the reason' translates αἰτιολογῶν, which (as an anonymous reader points out) looks forward to Ptolemy's word αἴτιον, 'reason', at the beginning of the next lemma.

⁶⁴ The Greek is *harmogai*, 'fittings-together'; the sense, I think, is no different from that conveyed elsewhere in the passage by *parabolai*, 'juxtapositions'.

μενον λαμβάνωμεν, οἷον τὸ ἑβδομον ἢ τὸ ἑπταπλάσιον, καὶ μὴ διὰ τινων προχειροτέρων ὥς ὅταν τὸ μὲν ὄγδοον τῷ πρότερον τὸ ἡμισυ καὶ τούτου τὸ ἡμισυ καὶ ἔτι τούτου τὸ ἡμισυ, τὸ δὲ ὀκταπλάσιον τῷ πρότερον τὸ διπλάσιον καὶ τούτου τὸ διπλάσιον καὶ ἔτι τούτου τὸ διπλάσιον. οὐκέτι [5] γὰρ ἔσται τὸ ὄγδοον τοῦ ἐνός ἢ τὸ ὀκταπλάσιον εἰλημμένον, ἀλλὰ πλείονων ἀνίσων τὰ ἡμίσεα καὶ τὰ διπλάσια.

- (19) Τὸ παρὰ τὸν δοθέντα ἀριθμὸν ἢ μέγεθος ἢ ἰσοῦν ἢ αὖξιν ἢ μειοῦν
 (20) ἄλλο τι τῶν ὁμογενῶν παραβάλλειν ἔλεγον. δοθείσης γοῦν εὐθείας συναρμόσαι μείζονα ἢ ἐλάσσονα ἢ ὁμοίαν πολλαπλασιάσαι παραβαλεῖν λέγουσι. τὸ τοίνυν τῇ δοθείσῃ εὐθείᾳ μείζονα ἢ ἐλάττονα παραβαλεῖν προχειρότατόν φησιν εἶναι. τὸ δὲ πρόχειρον οὐχ ὅτι τὸ μείζονα ἢ ἐλάττονα παραβαλεῖν, ἀτ' ἐν πλάτει διὰ τὸ ἀδιόριστον κείμενον, εὐμαρές—ἀπλῶς
 (25) γὰρ ἢ μείζονα ἢ ἐλάττονα λαβεῖν προβέβληται—ἀλλ' ὅτι καὶ μία ἢ παραβολή, καὶ πρὸς τὸ τυχὸν γίνεσθαι προβέβληται. πάλιν δὲ τὸ ἢ δίχα τεμεῖν ἢ διπλασιάσαι δύο μὲν ἐστὶ ποιῆσαι παραβολάς. καὶ γὰρ ὁ δίχα διαιρῶν ἰσῶσαι τὰ μέρη καὶ παραβάλλειν ἀλλήλοις βούλεται καὶ ὁ διπλασιάσας δις τῷ αὐτῷ λαβεῖν ἴσον. δις οὖν μετρῶν ὁ δίχα διαιρῶν καὶ
 (30) ὁ διπλασιάζων δύο ἐξ ἀνάγκης ποιεῖται τὰς παραβολάς. τὸ δὲ τοιοῦτο
 (21) πρόχειρον μὲν μὴ δὲ ὁμοίως τῷ ἀπλῶ μείζον ἢ ἐλάττον ἐφαρμόσαι. τὸ μέντοι τρεῖς παραβολάς ποιῆσαι ἥτοι διαιροῦντα εἰς τρία ἢ τριπλασιάζοντα ἤδη δύσκολον. αἱ γὰρ ἐφαρμογαὶ ἐνταῦθα ἤδη πλείους καὶ κατὰ λόγον δὲ δὴ τὰ ἐν πλείοσι παραβολαῖς δυσεφικτότερα· οὐ μὴν αἰεὶ γε
 (5) τοῦτο, ἀλλ' ὅταν αὐτά τις καθ' ἑαυτὰ λαμβάνῃ τὰ ζητούμενα, οἷον ἀξιῶν ὀκταπλασιάσαι τὸ πηχυαῖον ἢ τὸ ὄγδοον λαβεῖν ὀκταπῆχες, εἰ γὰρ διὰ τινων προχειροτέρων, οὐκ ἔσται χαλεπὸν. διδάσκει δ' ὅπως διὰ τῶν

21 παραβάλλειν T 28 διπλασιάσαι T

1 μὴ δὲ Wallis ἢ codd. μὴ Alexanderson 4 δὴ Düring δεῖ codd.

in lemmate: 4.21 ante τεμεῖν add. δὲ MEp 24 ἐπὶ ἐν ME 27 τό^{sec}] τῷ Mp 28 καὶ ἔτι τούτου τὸ ἡμισυ om. Mp 29 καὶ τούτου τὸ διπλάσιον om. M

of measuring operations. This is so when we construct the thing we are looking for simply as itself, the seventh or the seven-times multiple, for instance, and not through easier stages, as when we construct an eighth by first constructing a half, then the half of that, and then again the half of that, or the eight-times multiple by first constructing the double, then the double of that, and then again the double of that. For here it will no longer be the eighth of the one, or its eight-times multiple, that has been grasped, but the halves or the doubles of several unequal things. Ptol. *Harm.* 4.19–5.2

Given a number or a magnitude, people used to speak of making something else of the same sort either equal to it, or larger or smaller, | as ‘juxtaposing’;⁶⁵ at any rate, they speak of fitting a larger or a smaller straight line together⁶⁶ with a given one, or multiplying similar ones, as ‘juxtaposing’. Thus Ptolemy says that it is very easy to juxtapose a greater or smaller straight line with a given one. Its easiness is due not to the fact that juxtaposing a greater or a smaller is straightforward because of the vagueness arising from its indeterminacy – for | what has been proposed is simply to construct a greater or a smaller – but to the fact that there is only one juxtaposition, and what has been proposed is to make a juxtaposition with any random case. Again, to divide in half or to double is to make two juxtapositions. For someone who divides in half is trying to equalise the parts and juxtapose them with one another, and someone who doubles is trying to construct something equal to the same thing taken twice. Thus in measuring twice, the person who divides in half | is necessarily making two juxtapositions, and so is the person who doubles. This sort of thing is not quite as easy as is simply fitting something greater or smaller <to some other thing>.⁶⁷ It is already difficult, however, to make three juxtapositions, either when dividing into three or when tripling. For these cases involve more collocations,⁶⁸ and those which demand more numerous juxtapositions are proportionately harder to achieve. Not that this is always the case; | it is so only when someone constructs the items that are sought just by themselves, as when one tries to multiply a foot length by eight or to construct an eighth of an eight-foot length, for if it is done by simpler stages it will not be difficult.

[21D]

⁶⁵ The verb is *paraballein*, cognate with the noun *parabolē* (n. 61 above).

⁶⁶ ‘Fitting . . . together’ represents *synharmosai*, a compound of the verb cognate with Ptolemy’s *harmogai* (n. 64 above).

⁶⁷ ‘Fitting . . . to’ represents *epharmosai*, from the verb *epharmozein*, another compound cognate with *harmogē*.

⁶⁸ The noun is *epharmogai*. I can think of no more appropriate translation here than the ‘collocations’ I used for Ptolemy’s *harmogai* above, which in any case is the usage to which Porphyry is implicitly referring. It is worth noting that all these words are cognate also with regular terms in the musical vocabulary, such as *harmonia*, ‘attunement’ and *to hērmosmenon*, ‘that which has been attuned’.

- προχειροτέρων οὐκ ἔσται χαλεπόν. φέρε γὰρ τοῦ ὀκταπήχεος θέλειν λαβεῖν τὸ ὄγδοον. τὸ μὲν οὖν αὐτόθεν εἰς ὀκτῶ ἴσα μερίσαι καὶ οὕτω
- (10) λαβεῖν τὸ πηχυαῖον οὐκ εὐμαρές, διὰ τὸ ὀκτῶ γίνεσθαι τὰς παραβολὰς· τὸ δὲ διαιρεῖν δίχα, οἷον τετράπηχυ καὶ τετράπηχυ ποιήσαντα καὶ πάλιν ἐν τῶν τετραπήχεων εἰς δύο διπηχυαῖα, ἔπειτα ἐν τῶν διπηχυαίων διελεῖν δίχα καὶ οὕτω λαβεῖν τὸ ὄγδοον εὐμαρές. φέρε δ' ὀκταπλασιάσαι προκεῖσθαι τὸ πηχυαῖον. τὸ μὲν οὖν αὐτόθεν πάλιν οὐκ εὐμαρές δήπου
- (15) διὰ τὴν εἰρημένην αἰτίαν· τὸ δὲ διπλασιάσαι πρότερον καὶ ποιῆσαι διπηχυαῖον, ἔπειτα καὶ τοῦτο διπλασιάσαι καὶ τετράπηχυ ἀποτελέσαι καὶ πάλιν τοῦτο καὶ ποιῆσαι τὸ προβληθὲν εὐμαρέστερον. τρεῖς γὰρ αἱ παραβολαὶ καὶ οὐκ ὀκτῶ. οὕτω γὰρ ποιοῦντι οὐκέτι ἔσται τὸ ὄγδοον τοῦ ἐνὸς μεγέθους ἐν τῷ μερισμῷ ἢ τὸ ὀκταπλάσιον ἐν τῷ πολλαπλασιασμῷ, ἀλλ' ἐπὶ μὲν τοῦ μερισμοῦ πλεόνων ἀνίσων τὰ ἡμίση, οἷον τῶν ὀκτῶ καὶ τεσσάρων καὶ δύο, ἵνα τῶν ὀκτῶ ληφθῇ τὸ ὄγδοον τὸ ἐν, ἐπὶ δὲ τοῦ πολλαπλασιασμοῦ πλεόνων ἀνίσων τὰ διπλάσια, οἷον τοῦ ἐνός, δύο, τεσσάρων, ἵνα ὀκταπλάσια τοῦ ἐνός γένηται τὰ ὀκτῶ.

τῶν ὁμοίων οὖν καὶ περὶ τοὺς

ψόφους καὶ τὴν ἀκοὴν συμβεβηκότων καθάπερ ταῖς ὤψεσι δεῖ τινος πρὸς ἐκείνα κριτηρίου λογικοῦ διὰ τῶν οἰκείων ὀργάνων, οἷον πρὸς μὲν αὐτὸ τὸ εὐθὺ τῆς στάθμης φέρε εἰπεῖν, πρὸς δὲ τὸν κύκλον καὶ τὰς τῶν [5] μερῶν καταμετρήσεις τοῦ καρκίνου. τὸν αὐτὸν τρόπον καὶ ταῖς ἀκοαῖς διακόνους οὐσαις μάλιστα μετὰ τῶν ὤψεων τοῦ θεωρητικοῦ καὶ λόγον ἔχοντος μέρους τῆς ψυχῆς, δεῖ τινος ἀπὸ τοῦ λόγου, πρὸς ἃ μὴ πεφύκασιν κρίνειν ἀκριβῶς, ἐφόδου, πρὸς ἣν οὐκ ἀντιμαρτυρήσουσιν ἀλλ' ὁμολογήσουσιν οὕτως ἔχειν. [10]

- (25) ὥς οὖν ἐν τοῖς μεγέθεσιν οὐκ εὐμαρές τῇ ὁράσει καθ' ἑαυτὴν φωρᾶσαι τὰς συμμετρίαις, οὕτω κἀν τοῖς ψόφοις οὐ ῥᾶστον τῇ ἀκοῇ δι' αὐτῆς καταλαβεῖν τὸ ἡρμοσμένον. καθάπερ οὖν τῇ ὁράσει ὁ λόγος ἐξεῦρε βοήθειαν οἰκείαν προσθεῖς ὄργανα, οἷον πρὸς μὲν τὴν τοῦ εὐθέος ἀπότασιν δούς στάθμην, πρὸς δὲ τὸ τοῦ κύκλου περιαγές καὶ τὰς τῶν μερῶν
- (30) καταμετρήσεις τὸν καρκίνον, τὸν αὐτὸν τρόπον καὶ ταῖς ἀκοαῖς δεῖ τινος οἷον ὀργάνου παρὰ τοῦ λόγου καὶ ἐφόδου, πρὸς ἃ μὴ πεφύκασιν καθ' ἑαυτὰς ἀκριβῶς κρίνειν, πρὸς ἣν ἐφοδὸν οὐκ ἀντιμαρτυρήσουσιν, ὁμολο-
- (22) γήσουσι δ' οὕτως ἔχειν. δύο γὰρ αὗται μάλιστα αἰσθήσεις ὑπηρετικά

8 ἔσται om. MG 9 ante τό^{sec} add. εἰ γάρ sed compunxit et add. in marg. διδάσκει δ' ὅπως
 διὰ τῶν προχειροτέρων οὐ χαλεπόν T ἴσα — 10 ὀκτῶ om. T 14 διπηχυαῖον T corr. m.a.
 22 τοῦ ἐνός Alexanderson τὸ ἐν codd. 29 περιαγές ETV⁸⁷G περιαιγές M περιαλγές p

Ptolemy explains in what way it will not be difficult if it is done by simpler stages. Suppose that one wishes to construct an eighth of an eight-foot length. Dividing it into eight equal parts directly and | constructing the foot length in this way is not straightforward, since it involves eight juxtapositions. But it is a straightforward matter to divide it in half, making two four-foot lengths, and again to divide one of the four-foot lengths into two two-foot lengths, and then to divide one of these two-foot lengths in half and in this way to construct the eighth. Or suppose the task proposed is to multiply a foot length by eight. To do it directly is once again not straightforward, | for the reason stated. It is more straightforward, however, to double it first, making a two-foot length, then to double that, producing a four-foot length, and again to double this last, so as to make the length proposed, since there are now three juxtapositions, not eight. When a person proceeds in this way, there will not be an eighth of a single magnitude in his division or an eight-times multiple in his multiplication, | but in the case of division there will be the halves of several unequal items (of 8 and 4 and 2, for instance, to construct an eighth of 8, that is, 1), and in the case of multiplication there will be the doubles of several unequal items (of 1, 2 and 4, for instance, to produce the eight-times multiple of 1, that is, 8).

Since similar things occur in relation to sounds and to the hearing, some rational criterion is needed for them, working through appropriate instruments, like the ruler for straightness, for example, or the compasses for the circle and the measurement of its parts. In the same way the ears, which along with the eyes are the principal servants of the theoretical and rational part of the soul, need some method based on reason to deal with things that they are not capable of judging accurately, a method against which they will not bear witness, but which they will agree is correct. Ptol. *Harm.* 5.2–10

| Just as in the case of magnitudes it is no simple matter for sight by itself to discover the proper proportions, so it is not very easy, in the case of sounds, for hearing through its own resources to grasp what is attuned. So just as reason has found appropriate help for sight by bringing instruments to bear, giving it the ruler, for instance, for the construction of straight lines and the compasses for the circumference of a circle and the | measurement of its parts, in the same way the ears need some sort of instrument and a method based on reason, to deal with things that they are not naturally equipped to judge accurately by themselves, a method against which they will not bear witness, but which they will agree is correct. For these two senses, sight and hearing, which are especially devoted to the service of

[22D]

- τοῦ λόγου πρὸς τὰς θεωρίας αὐτοῦ δέδονται παρὰ τῆς φύσεως, ὅρασις καὶ ἀκοή. διὸ καὶ πολλὴ φροντίς γέγονε τῷ λόγῳ, ὅπως ἀδιάπτωτοι αὐτῷ εἶεν αἱ ὑπηρετίδες, ὁράσει μὲν δόντι ὄργανα οἰκεῖα, δι' ὧν τὸ
- (5) προσὸν αὐτῇ ἑλλιπὲς ἐπανορθοῦται· ἀκοῇ δ' ἐξεῦρέ τινα ἔφοδον, δι' ἧς προοιούσα ἀδιάπτωτος γίνεται πρὸς τὴν κρίσιν τῶν ψόφων. τίς οὖν ἔφοδος καὶ τίς καλεῖται ἐπάγει.

β'

Τὸ μὲν οὖν ὄργανον τῆς τοιαύτης ἐφόδου καλεῖται κανὼν ἀρμονικός, ἀπὸ τῆς κοινῆς κατηγορίας καὶ τοῦ κανονίζειν τὰ ταῖς αἰσθήσεσιν ἐνδέοντα πρὸς τὴν ἀλήθειαν παρειλημμένος.

- (10) Τὸ ὄργανον τῆς ἐφόδου φησίν, ἣν ὁ λόγος ἐξεῦρέ τε καὶ δέδωκε ταῖς αἰσθήσεσι πρὸς τὸ κανονίζειν τὰ ἐνδέοντα αὐταῖς πρὸς τὴν ἀλήθειαν, κανὼν καλεῖται ἀρμονικός ἀπὸ τῆς κοινῆς προσηγορίας τοῦ εὐρίσκοντος ὄργανον τὸ ἐλλείπον ταῖς αἰσθήσεσιν εἰς τὴν ἀκρίβειαν, ὃ καλεῖται κανὼν, οὕτω κεκλημένος. πάντα γὰρ τὰ πρὸς τοῦτο ἐπιτήδεια ὄργανα ταῖς
- (15) αἰσθήσεσι <οὕτω> καλεῖται. οὐ γὰρ δὴ κανὼν, οὐδὲ κανονικὴ αἰσθήσει ἔφοδος κέκληται ἢ κατὰ τὴν ἀρμονικὴν θεωρίαν ἀπὸ τοῦ κατὰ τὰς κιθάρας καλουμένου κανόνος, ἔνθα διατείνονται αἱ χορδαί, ἀλλ' οἱ Πυθαγόρειοι, οἵπερ καὶ μάλιστα τὴν ἔφοδον εὔρον, κανονικὴν μὲν ἐκάλουν, ἣν νῦν ἀρμονικὴν λέγομεν θεωρίαν συνωνύμως, κανόνα δὲ τὸ τῆς ὀρθότητος
- (20) τῶν συμμετρικῶν μέτρον, ὃ καὶ ὀρίζονται τινες αὐτῶν οὕτω. “κανὼν ἐστὶ μέτρον ὀρθότητος τῶν ἐν τοῖς φθόγγοις ἡρμοσμένων διαφορῶν, αἱ θεωροῦνται ἐν λόγοις ἀριθμῶν.” γράφει γέ τοι περὶ τούτου καὶ Πτολεμαῖς ἡ Κυρηναία ἐν τῇ Πυθαγορικῇ τῆς μουσικῆς στοιχειώσῃ ταῦτα.

4 αὐτῷ m αὐτῶν ceteri 5 αὐτῇ om. G ἐπανορθοῦται scripsi ἐπανορθοῦνται codd. 8 κεφ. β' Τίς πρόθεσις ἀρμονικοῦ T Ἀρχὴ τοῦ β' κεφαλαίου τῶν πτολεμαίου ἀρμονικῶν p 12 προσηγορίας] κατηγορίας g 15 <οὕτω> add. Düring κανονικῇ MEg 16 κατὰ^{acc.} om. g 20 ὃ καὶ om. g 21 αἱ] οἱ T

in lemma: 5.13 παρειλημμένον mp

reason, have been provided by nature to assist in reason's enquiries. So reason has taken a great deal of thought about how its maid-servants might be made infallible in these matters, by giving sight appropriate instruments through which the | deficiency that it has is put right;⁶⁹ and for hearing it discovered a method by proceeding through which it becomes infallible in its judgement of sounds. He next explains what the method is and what it is called.

Chapter 2

The instrument of this kind of method is called the harmonic *kanōn*, a term adopted out of common usage, and from its straightening (*kanonizein*) those things in the senses that are inadequate to reveal the truth. Ptol. *Harm.* 5.11–13

| He says that the instrument of the method which reason discovered and gave to the senses, in order to straighten their deficiencies in relation to the truth, is called the harmonic *kanōn*,⁷⁰ taking its name from the general designation of the instrument called the *kanōn* which finds out what the senses lack in respect of accuracy; for all instruments which are useful to the | senses for this purpose are called by this name. For it is not called the *kanōn*, and neither is the method used by perception in harmonic theory called *kanonikē*, by derivation from what is called the *kanōn* on the kithara, the part from which the strings are stretched. Rather, the Pythagoreans, who were the principal discoverers of the method, called by the name *kanonikē* the same discipline that we now call *harmonikē*, and they called the measure⁷¹ of the correctness | of the proportions the *kanōn*, which some of them define as follows: 'The *kanōn* is the measure of the correctness of the differences attuned among the notes, differences which are theoretically grasped in ratios of numbers.'⁷² On this subject Ptolemaïs of Cyrene also writes the following, in her *Pythagorean elements of music*.⁷³

⁶⁹ For Ptolemy's fuller discussion of sight and hearing as the servants and helpers of reason, see *Harm.* 93.11–94.20.

⁷⁰ In its widest sense the word *kanōn* refers to a ruler used for drawing straight lines or as a measuring device (a different word for 'ruler', *stathmē*, has been used earlier in the passage), or to any kind of straight stick or rod. In harmonics it originally referred to the ruler placed under or alongside the string of a monochord, marked off at the end-points of measured sections, whose lengths were related in the ratios prescribed by mathematical theory; these were the points at which the bridge under the string should be placed to create the appropriate musical intervals. Subsequently, the name was often transferred to the instrument itself.

⁷¹ The 'measure' (*metron*) of something is that by which it is measured, in either of two senses. In this passage it is the measuring instrument; more commonly it is the unit of measurement.

⁷² If this is a direct quotation, its source is unknown.

⁷³ On Ptolemaïs and the passages from her work quoted below see Creese (2010): 75–8, 214–33.

- (25) “Ἡ οὖν κανονικὴ πραγματεία, κατὰ τίνας μᾶλλον ἐστὶ καθόλου κατὰ τοὺς Πυθαγορικοὺς· ἦν γὰρ νῦν ἀρμονικὴν λέγομεν, ἐκεῖνοι κανονικὴν ὠνόμαζον. ἀπὸ τίνος κανονικὴν αὐτὴν λέγομεν; οὐχ ὥς ἔνιοι νομίζουσι ἀπὸ τοῦ κανόνος ὄργανον παρονομασθεῖσαν, ἀλλ’ ἀπὸ τῆς εὐθύτητος ὡς διὰ ταύτης τῆς πραγματείας τὸ ὀρθὸν τοῦ λόγου εὐρόντος καὶ τὰ τοῦ ἡρμοσμένου παραπήγματα.
- (23) Κανονικὴν γέ τοι καλοῦσι καὶ τὴν ἐπὶ συρίγγων καὶ αὐλῶν καὶ τῶν ἄλλων πραγματείαν, καίτοι τούτων μὴ κανονικῶν ὄντων, ἀλλ’ ἐπεὶ αὐτοῖς οἱ λόγοι καὶ τὰ θεωρήματα ἐφαρμόζουσι, κανονικὰ καὶ ταῦτα προσαγορεύουσι. μᾶλλον οὖν τὸ ὄργανον ἀπὸ τῆς κανονικῆς πραγματείας
- (5) κανὼν ὠνομάσθη. κανονικὸς δ’ ἐστὶ καθόλου ὁ ἀρμονικὸς ὁ περὶ τοῦ ἡρμοσμένου ποιούμενος τοὺς λόγους. διαφέρουσι δὲ μουσικοὶ καὶ οἱ κανονικοί. μουσικοὶ μὲν γὰρ λέγονται οἱ ἀπὸ τῶν αἰσθήσεων ὀρμώμενοι ἀρμονικοί, κανονικοὶ δ’ οἱ Πυθαγορικοὶ οἱ ἀρμονικοί. εἰσὶ δὲ καὶ ἑκάτεροι τῷ γένει μουσικοί.”
- (10) Οἷς ἐπάγει κατ’ ἐρώτησιν πάλιν καὶ ἀπόκρισιν· “ἢ κατὰ τὸν κανόνα θεωρία, ἐκ τίνων σύγκειται; ἐκ τῶν παρὰ τοῖς μουσικοῖς ὑποτιθεμένων καὶ ἐκ τῶν παρὰ τοῖς μαθηματικοῖς λαμβανομένων.”

25 ὁρος κανόνος παρὰ πτολεμαῖδος τῆς Κυρηναίας μουσικῆς T

3 οἱ λόγοι] ὀλίγοι g 8 post οἱ Πυθαγορικοὶ ut glossema οἱ ἀρμονικοὶ secludendum suspicor καὶ om. g

| The science of *kanonikē* – of whom is it mainly characteristic? In general, of the Pythagoreans; for what we now call *harmonikē* they used to name *kanonikē*. From what do we take for it the name *kanonikē*? It is not so called, as some people think, by transference from the instrument known as the *kanōn*,⁷⁴ but from straightness, on the grounds that it is through this science that reason discovers what is correct, and the | *parapēgmata*⁷⁵ of that which is attuned.

[23D]

People also give the name *kanonikē* to the enquiry that uses Panpipes and auloi and so on, even though these are not ‘canonic’;⁷⁶ but because the ratios and theorems apply to them, they too are called ‘canonic’. The fact is rather, then, that the instrument was called the *kanōn* by derivation from the | discipline of *kanonikē*. In general a *kanonikos* is a *harmonikos*,⁷⁷ someone who talks about attunement.⁷⁸ But there is a difference between *mousikoi*⁷⁹ and *kanonikoi*. Those called *mousikoi* are the *harmonikoi* who set off from perception, while those called *kanonikoi* are the Pythagorean *harmonikoi*.⁸⁰ Both, however, are *mousikoi* in the generic sense of the word.⁸¹

| To these remarks Ptolemaïs adds, returning to the question-and-answer form: ‘The enquiry based on the *kanōn* – from what elements is it constituted? From the things posited by the *mousikoi* and those adopted by the mathematicians.’

⁷⁴ Ptolemaïs is almost certainly wrong about this; see Creese (2010): 76.

⁷⁵ *Parapēgmata*, literally ‘things fixed alongside’, are in some cases calendars (made of stone or some other solid material) whose entries designated astronomical or meteorological events. Beside each entry was a hole in which a peg could be placed to mark the present date, thus allowing users to locate themselves within the sequence of past and future events. Ptolemaïs may have had this usage in mind; we might loosely paraphrase by saying that *kanonikē* provides a ‘map’ of the harmonic system (but for closer analysis of the word’s application here see Creese (2010): 75–6). On *parapēgmata* in general see Lehoux (2007) and cf. e.g. Hannah (2002). Another interpretation is possible, however. In some texts (six times in Sextus Empiricus *Adv. Math.* I, for instance) a *parapēgma* is a rule or principle by which something is governed, a firm mooring to which it is fastened, as it were, to hold it securely in place. This could be what Ptolemaïs intended, if (as the sequel seems to suggest) the science of *kanonikē*, as she conceives it, includes not only the studies and operations connected directly with the monochord but also, in effect, the whole of mathematical harmonics.

⁷⁶ That is, the pitches produced from given sounding-lengths of these instruments’ pipes are too variable, and their relative sounding-lengths are not determinable with sufficient precision for them to be reliable witnesses to the correct ratios. See further 119.13–121.14 below, commenting on Ptol. 16.32 ff.

⁷⁷ I.e. a student of harmonics.

⁷⁸ I am persuaded by Hagel’s argument in favour of this translation, rather than one that construes λόγους in the sense ‘ratios’. See Hagel (2012b): 343–4.

⁷⁹ The term *mousikos* can be applied to any artist, scientist or connoisseur of *mousikē*, which may be ‘music’ or more generally any art that falls within the province of the Muses. As the next sentence shows, however, Ptolemaïs is using it here to designate a musical theorist or scientist (a *harmonikos*) who is not a *kanonikos* (no doubt with Aristoxenus and his followers principally in mind).

⁸⁰ I suspect that what Ptolemaïs wrote was simply ‘... are the Pythagoreans’, and that the expression *harmonikoi* has crept into the text from a reader’s marginal note.

⁸¹ Düring does not represent this paragraph as part of the quotation from Ptolemaïs. I agree with Alexanderson that it should be included.

- Ἔστι δὲ τὰ παρὰ τοῖς μουσικοῖς ὑποτιθέμενα, ὅσα παρὰ τῶν αἰσθήσεων λαμβάνουσιν οἱ κανονικοί, οἷον τὸ εἶναι τινα σύμφωνα καὶ διάφωνα
- (15) διαστήματα καὶ τὸ εἶναι σύνθετον τὸ διὰ πασῶν ἔκ τε τοῦ διὰ τεσσάρων καὶ τοῦ διὰ πέντε καὶ τὸ εἶναι τόνον τὴν δ' ὑπεροχὴν τοῦ διὰ πέντε παρὰ τὸ διὰ τεσσάρων καὶ τὰ ὅμοια. τὰ δὲ παρὰ τοῖς μαθηματικοῖς λαμβανόμενα, ὅσα ἰδίως οἱ κανονικοὶ τῷ λόγῳ θεωροῦσιν ἔκ τῶν τῆς αἰσθήσεως ἀφορμῶν μόνον κινηθέντες, οἷον τὸ εἶναι ἐν ἀριθμῶν λόγοις τὰ διαστήματα καὶ τὸ εἶναι ἐξ ἀριθμοῦ συγκρούσεων τὸν φθόγγον καὶ τὰ παραπλήσια. τὰς ὑποθέσεις οὖν τῆς κανονικῆς διορίσειεν ἂν τις ὑπάρχειν τῇ τε περὶ τὴν μουσικὴν ἐπιστήμῃ καὶ τῇ περὶ τοὺς ἀριθμούς καὶ τὴν γεωμετρίαν.
- (20)

ἁρμονικοῦ δ' ἂν εἴη πρόθεσις

τὸ διασῶσαι πανταχῇ τὰς λογικὰς ὑποθέσεις τοῦ κανόνος μηδαμῇ μηδამῶς ταῖς αἰσθήσεσι μαχομένας κατὰ τὴν τῶν πλείστων ὑπόληψιν, ὥς [15] ἀστρολόγου τὸ διασῶσαι τὰς τῶν οὐρανίων κινήσεων ὑποθέσεις συμφώνους ταῖς τηρουμέναις παρόδοις, εἰλημμένας μὲν καὶ αὐτὰς ἀπὸ τῶν ἐναργῶν καὶ ὀλοσχερέστερον φαινομένων, εὐρούσας δὲ τῷ λόγῳ τὰ κατὰ μέρος ἐφ' ὅσον δυνατὸν ἀκριβῶς. ἐν ἅπασι γὰρ ἰδίῳ ἐστι τοῦ θεωρητικοῦ καὶ ἐπιστήμονος τὸ δεικνύναι τὰ τῆς φύσεως ἔργα μετὰ [20] λόγου πινός καὶ τεταγμένης αἰτίας δημιουργούμενα καὶ μηδὲν εἰκῇ, μηδὲ ὥς ἔτυχεν ἀποτελούμενον ὑπ' αὐτῆς καὶ μάλιστα ἐν ταῖς οὕτω καλλίσταις κατασκευαῖς, ὅποῃαι τυγχάνουσιν αἱ τῶν λογικωτέρων αἰσθήσεων, ὅπως καὶ ἀκοῆς.

- (24) Περί τούτων γράφει ἡ Πτολεμαῖς ἐν τῇ εἰρημένη εἰσαγωγῇ
- (25) ταῦτα. “Πυθαγόρας καὶ οἱ διαδεξάμενοι βούλονται τὴν μὲν αἴσθησιν ὥς ὁδηγὸν τοῦ λόγου ἐν ἀρχῇ παραλαμβάνειν πρὸς τὸ οἰοῖναι ζώπυρά τινα παραδιδόναι αὐτῷ, τὸν δὲ λόγον ἔκ τούτων ὀρμηθέντα καθ' ἑαυτὸν πραγματεύεσθαι ἀποστάντα τῆς αἰσθήσεως, ὅθεν κἂν τὸ σύστημα τὸ ὑπὸ τοῦ λόγου εὐρεθῇ τῆς πραγματείας μηκέτι συνάδῃ τῇ αἰσθήσει, οὐκ ἐπιστρέφονται, ἀλλ' ἐπεγκαλοῦσι λέγοντες τὴν μὲν αἴσθησιν πλανᾶσθαι, τὸν δὲ λόγον εὐρηκέναι καθ' ἑαυτὸν τὸ ὀρθὸν καὶ ἀτελέγχειν τὴν αἴσθησιν.
- (30)
- (24) Ἐναντίως δὲ τούτοις ἔνιοι τῶν ἀπ' Ἀριστοξένου μουσικῶν φέρον-

19 μόνον — 20 ἀριθμοῦ om. G 20 ἀριθμοῦ συγκρούσεων sc̄ipsi ἀριθμῶν συγκρουστῶν codd.

27 αὐτῷ Düring αὐτοῖς codd. 29 μηκέτι] μηδὲν τι g 30 ἐπικαλοῦσι g

in lemmate: 5.17 τηρουμέναις] τετηρημέναις MΕρ 18 ὀλοσχερεστέρων M

1 Ἀριστοξένους g

The 'things posited by the *mousikoi*', those of them that the *kanonikoi* take from the senses, are for instance that there are concordant and discordant | intervals, that the octave is put together from the fourth and the fifth, that the tone is the excess of a fifth over a fourth, and other things of that sort. The things 'adopted by the mathematicians', those things whose study by means of reason is peculiar to the *kanonikoi* (who are only prompted by the starting-points provided by perception), are for instance that the intervals are in ratios of numbers, | that a note is composed of a number of collisions,⁸² and other such things. One might therefore define the postulates of *kanonikē* as belonging both to the science of music and to that concerned with numbers and geometry.

The aim of the student of harmonics must be to keep the rational postulates of the *kanōn* safe in all respects, never conflicting at any point with the senses' perceptions (as most people apprehend them), just as the astronomer's aim is to keep safe the postulates concerning the movements of the heavenly bodies, in concord with their carefully observed courses, these postulates themselves having been taken from the clearly apparent, rough and ready phenomena, but discovering the details as accurately as possible through reason. For in everything it is the business of the theoretical scientist to show that the works of nature are crafted with reason and with an orderly cause, and that nothing is produced by nature at random or just anyhow, especially in its most beautiful constructions, the kinds that belong to the more rational of the senses, sight and hearing. Ptol. *Harm.* 5.13–24

Ptolemaïs writes as follows about these matters in the introductory treatise I have | mentioned.

Pythagoras and his successors wish to adopt perception as a guide for reason at the outset to provide it with a spark, as it were, but to treat reason, when it has set out from these starting-points, as working on its own in separation from perception. Hence if the system⁸³ discovered by reason in its investigation no longer accords with perception, they do not turn back but | lay the blame on perception, saying that it is going astray, while reason has discovered by itself what is correct and refutes perception. On the opposite side to these people are some of the *mousikoi* who follow Aristoxenus,

[24D]

⁸² The received text, τὸ εἶναι ἐξ ἀριθμῶν συγκρουστῶν τὸν φθόγγον, can only mean 'that a note is composed of numbers beaten together', which as far as I can see is unintelligible. No other Greek source couples the adjective συγκρουστός either with the noun ἀριθμός or with any comparable term. The text I have printed (we might read συγκρουσμῶν instead of συγκρούσεων) will give the sense conveyed in my translation. For the theory to which this would refer see 30.6–31.21 below.

⁸³ That is, the musical scale as represented by a sequence of ratios.

- ται, ὅσοι κατὰ μὲν τὴν ἔννοιαν θεωρίαν ἔλαβον, ἀπὸ δ' ὀργανικῆς ἕξεως προκόψαντες. οὗτοι γὰρ τὴν μὲν αἴσθησιν ὡς κυρίαν θεάσαντο, τὸν δὲ λόγον ὡς παρεπόμενον, πρὸς μόνον τὸ χρεῖδες.” κατὰ δὲ τούτους
- (5) εἰκότως οὐ πανταχῇ αἱ λογικαὶ ὑποθέσεις τοῦ κανόνος σύμφωνοι ταῖς
- (6-7) αἰσθήσεσιν, ὁ δὲ Πτολεμαῖος πεπειράται μηδαμῇ μηδαμῶς ταῖς αἰσθήσεσι μαχομένης κατὰ τὰς τούτων ὑπολήψεις τὰς λογικὰς ὑποθέσεις τοῦ κανόνος ἐπιδείξει καὶ τοῦτο αὐτοῦ μάλιστα ἐξαίρετον τῆς ἀρμονικῆς ἐστὶ πραγμα-
- (10) τείας καὶ διὰ τοῦτο παρηλλαγμένον τῆς τῶν ἐκείνων ἀνδρῶν διαιρέσεως. ταῦτό δὲ καὶ ἐν τοῖς ἀστρολογικοῖς πεποίηκεν ἡγούμενος ἀστρολόγου πρόθεσιν δεῖν εἶναι τὸ διασῶσαι τὰς τῶν οὐρανίων κινήσεων ὑποθέσεις συμφώνους ταῖς τηρουμέναις παρόδοις εἰλημμένας μὲν καὶ αὐτὰς ἀπὸ
- (15) τῶν ἐναργῶν τε καὶ ὀλοσχερέστερον φαινομένων, εὐρούσας δὲ τῷ λόγῳ τὰ κατὰ μέρος [οὐ μόνον] ἐφ' ὅσον δυνατὸν ἀκριβῶς. καὶ λέγει γ' ἐν ἀρχαῖς τῆς μαθηματικῆς πραγματείας ταυτὶ κατὰ λέξιν.
- “Ἐκαστα δὲ τούτων πειρασόμεθα δεικνύναι ἀρχαῖς μὲν καὶ ὥσπερ θεμελίους εἰς τὴν εὐρεσιν χρώμενοι τοῖς ἐναργέσι φαινομένοις καὶ ταῖς ἀδιστάκτοις τῶν παλαιῶν καὶ τῶν καθ' ἡμᾶς τηρήσεων, τὰς δ' ἐφεξῆς
- (20) τῶν καταλήψεων ἐφαρμόζοντες διὰ τῶν ἐν ταῖς γραμμικαῖς ἐφόδοις ἀποδείξεων.”
- Ὅρθως δὲ τὸ φάναι ἐν ἅπασιν ἴδιον εἶναι τοῦ θεωρητικοῦ καὶ ἐπιστήμονος τὸ δεικνύναι τὰ τῆς φύσεως ἔργα μετὰ λόγου τινὸς καὶ τεταγμένης αἰτίας δημιουργούμενα καὶ μηδὲν εἰκῇ, μηδ' ὡς ἔτυχεν ἀποτελούμενον
- (25) ὑπ' αὐτῆς. ἔλεγον γὰρ καὶ οἱ Πυθαγόρειοι καὶ παρηγγελλον τὸ εἰκῇ δεῖν ἐξορίζειν πανταχόθεν κακ τοῦ βίου κακ τῆς θεωρίας κακ τῶν πράξεων καὶ μηδαμῶς εἶναι ἐν τῇ φύσει οἶεσθαι, ὅτι καὶ αὕτη νοῦ ἀποτέ-

2 τὴν Düring ὅλον codd. 3 θεάσαντο] θεσαν coni. Düring 4 πρὸς] ὡς T τούτους] τοὺς T 9 τοῦτο Wifstrand τοῦ codd 10 ἐκείνων] ἐκκειμένων m 14 ὀλοσχερεστέρων m 15 [οὐ μόνον] del. Alexanderson 17 δεικνύναι] δεικνύειν Ptol. *Synt. math.* I.9.12 18 εὐρεσιν] ἀνεύρεσιν *Synt. math.* I.9.13 19 τῶν τε παλαιῶν *Synt. math.* I.9.14 26 ἐξορίζειν] καὶ ὀρίζειν p 27 αὕτη νοῦ Düring αὐτὴν οὐ mG αὕτῃ οὐ p

those who conceived themselves as undertaking theoretical enquiry, but who set out from expertise on instruments. For they conceived perception as being authoritative and reason as accompanying it, to be used only when needed.⁸⁴

According to these people | it is only to be expected that the rational postulates of the *kanōn* are not always in concord with perceptions;⁸⁵ but Ptolemy has tried to demonstrate that according to these people's own assumptions the rational postulates of the *kanōn* never conflict with the senses; and since this feature of his work on harmonics is altogether exceptional, | it falls outside the scope of the distinctions drawn between those men. He has done the same thing in his writings on astronomy, in the belief that the astronomer's project must be to 'keep safe the postulates concerning the movements of the heavenly bodies in concord with their carefully observed courses, these postulates themselves having been taken from the clearly apparent, rough and ready phenomena, but discovering the details | as accurately as possible through reason'. And at the beginning of his mathematical work⁸⁶ he writes as follows, in exactly these words: 'We shall try to show each of these things by taking the clearly apparent phenomena as the starting-points and as it were the foundations for discovery – both those observed by the ancient writers, when they are not in dispute, and those taken from our own observations – and by fitting the subsequent | theses to them through geometrical methods of demonstration.'

It is correct to say that 'in everything it is the business of the theoretical scientist to show that the works of nature are crafted with reason and with an orderly cause, and that nothing is produced by nature at random or | just anyhow'. For the Pythagoreans, too, asserted and declared that one must altogether exclude randomness from life and from theory and from actions, and must absolutely not suppose that it exists in nature, since nature is a

⁸⁴ The substance of this passage is repeated in the course of the next quotation from Ptolemaïs (25.9–26.4). It turns out there that the approach of the Aristoxenian *mousikoi* is to be distinguished from that of Aristoxenus himself, and that there is also a group of Pythagoreans who adopt a different position from the one attributed here to 'Pythagoras and his successors'.

⁸⁵ Düring treats this sentence as part of the quotation from Ptolemaïs, but it should almost certainly be assigned to Porphyry himself. The phrase 'the rational postulates of the *kanōn*' comes directly from Ptolemy (5.14, in a statement which Porphyry's next sentence paraphrases), and by translating the views of 'these people' into Ptolemy's terms Porphyry is able to put their position and his in direct confrontation with one another. My thanks to Massimo Raffa, to whom I owe these and several related points. It is possible that Porphyry's comment indicates that he identified them with the equally mysterious 'more recent' Aristoxenians he discusses at 130.27–131.10, who seem to make some use of conceptions drawn from mathematical harmonics alongside those of the mainstream Aristoxenian tradition. See nn. 601–3 ad loc., and cf. Introduction Section 5(a).

⁸⁶ I.e. the *Syntaxis mathēmatikē*, commonly known as the *Almagest*. The passage quoted is at 9.11–16 in Heiberg's edition.

- λεσμα, τὸ δὲ οὐ ἔνεκα καὶ διὰ τί ἐν νῶ. καλλίστας δὲ τῶν αἰσθήσεων
 (30) ὄρασιν καὶ ἄκοήν σχεδὸν πάντες οἱ φιλόσοφοι συγχωροῦσιν καὶ λογικάς
 τε ἔνιοι καθάπερ οὗτος καλοῦσιν, ὅτι μάλιστα αὐταὶ ὑπηρέτιδές εἰσι πρὸς
 τὴν οἰκίαν θεωρίαν τῷ λόγῳ.
- (25) ταύτης δὴ τῆς προθέσεως οἱ μὲν οὐδ' ὅλως εἰκόασι
 πεφροντικεῖναι μόνῃ τῇ χειρουργικῇ χρήσει καὶ τῇ φιλῇ καὶ ἀλόγῳ τῆς [25]
 αἰσθήσεως τριβῇ προσχόντες, οἱ δὲ θεωρητικώτερον τῷ τέλει προσενε-
 χθέντες. οὗτοι δ' ἂν μάλιστα εἶεν οἱ τε Πυθαγόρειοι καὶ οἱ Ἀριστοξένηι-
 [6] οἱ-διαμαρτεῖν ἑκάτεροι· οἱ μὲν γὰρ Πυθαγόριοι μὴδὲ ἐν οἷς ἀναγ-
 καῖον ἦν πᾶσι τῇ τῆς ἀκοῆς προσβολῇ κατακολουθήσαντες ἐφήρμοσαν
 ταῖς διαφοραῖς τῶν ψόφων λόγους ἀνοικίους πολλαχῇ τοῖς φαινομένοις,
 ὥστε καὶ διαβολὴν ἐμποιεῖσαι τῷ τοιούτῳ κριτηρίῳ παρὰ τοῖς ἑτερο-
 δόξοις. οἱ δὲ Ἀριστοξένειοι πλεῖστον δόντες τοῖς διὰ τῆς αἰσθήσεως [5]
 καταλαμβανομένοις ὁδοῦ πάρεργον ὥσπερ κατεχρήσαντο τῷ λόγῳ, καὶ
 παρ' αὐτὸν καὶ παρὰ τὸ φαινόμενον· παρ' αὐτὸν μὲν ὅτι μὴ ταῖς τῶν
 ψόφων διαφοραῖς ἐφαρμόζουσι τοὺς ἀριθμούς, τουτέστι τὰς εἰκόνας τῶν
 λόγων, ἀλλὰ τοῖς διαστήμασιν αὐτῶν, παρὰ τὸ φαινόμενον δὲ ὅτι καὶ
 τούτους ἐπὶ ἀνοικίων ταῖς αἰσθητικαῖς συγκαταθέσει παραβάλλουσι [10]
 μερισμῶν, ὧν ἕκαστον ἐξ αὐτῶν τῶν ἐπενεχθησομένων ἔσται δῆλον,
 ἐὰν πρότερον τὰ συντείνοντα πρὸς τὴν τῶν ἐφεξῆς παρακολούθησιν
 διορισμοῦ τινος τύχη.
- (3) Περὶ τούτων συντόμως μὲν καὶ ἡ Κυρηναία Πτολεμαῖς ἔγρα-
 ψεν ἐν τῇ εἰσαγωγῇ, ἐπῆλθε δὲ καὶ Δίδυμος ὁ μουσικὸς διὰ πλειό-
 (5) νων ἐν τῷ Περὶ τῆς διαφορᾶς τῶν Ἀριστοξενείων
 τε καὶ Πυθαγορείων. ἡμεῖς δὲ τὰ παρ' ἀμφοῖν ἀναγράψωμεν,
 ὀλίγα τῆς λέξεως συντομίας ἔνεκεν παρακινουῦντες. γράφει δὴ ἡ μὲν
 Πτολεμαῖς τάδε.
 “Τῶν ἐν τῇ μουσικῇ διαπρεψάντων τίς ἡ διαφορά; οἱ μὲν γὰρ τὸν
 (10) λόγον προέκριναν αὐτόν, οἱ δὲ τὴν αἴσθησιν, οἱ δὲ τὸ συναμφότερον. τὸν
 μὲν λόγον προέκρινον αὐτόν τῶν Πυθαγορείων ὅσοι μᾶλλον ἐφιλονείκησαν
 πρὸς τοὺς μουσικοὺς τελέως τὴν αἴσθησιν ἐκβάλλειν, τὸν δὲ λόγον ὡς
 αὐταρκες κριτήριον καθ' ἑαυτὸν εἰσφέρειν. ἐλέγχονται δ' οὗτοι πάντως
 τι αἰσθητὸν παραλαμβάνοντες ἐν ἀρχῇ καὶ ἐπιλανθανόμενοι. τὴν δ'

10 προέκρινον g 14 καὶ — 15 ὁργανικοὶ om. T

in lemmate: 5.24 οὐδ' ὅλως scripsi οὐδόλως Düring 6.2 ἅπασι MEp 3 πολλαχῇ] πολλαχῶς
 Mp 5 ante πλεῖστον add. τὸ MEp 8 ἐφαρμόττουσι Mp

product of intelligence, and its purpose and explanation are contained in intelligence. And almost all philosophers agree that the finest of the senses are sight and hearing, and some of them | call them 'rational', as Ptolemy does, because they above all are the maid-servants that assist reason in its own enquiries.⁸⁷

To this aim some people seem to have given no thought at all, devoting themselves to nothing but the use of manual techniques and the unadorned and irrational exercise of perception, while others have approached the objective too theoretically. These are above all the Pythagoreans and the Aristoxenians, and both are wrong. For the Pythagoreans did not follow the impressions of hearing even in all those things where it is necessary to do so, and to the differences between sounds they attached ratios that were often inappropriate to the phenomena, and so provided people who disagree with an opportunity for slandering this sort of criterion. The Aristoxenians, by contrast, gave most weight to the things grasped by perception, and misused reason as if it were incidental to the journey, contradicting both reason itself and the perceptible phenomena: contradicting reason in that they do not fit the numbers – that is, the images of the ratios – to the different attributes of the notes, but to the intervals themselves, and contradicting the phenomena in that they also attach the numbers to divisions which conflict with the submissions of the senses. Each of these points will become clear from the considerations I shall introduce later, if we first define the factors that contribute to an understanding of the issues that follow. Ptol. *Harm.* 5.24–6.13

[25D]

Ptolemaïs of Cyrene wrote briefly about these matters in her introductory treatise, and Didymus entered into them at greater length | in his *On the difference between the Aristoxenians and the Pythagoreans*.⁸⁸ We shall write out what each of them says, altering a few things for the sake of brevity. Ptolemaïs, then, writes as follows:

What is the difference between those who are eminent in musical theory? Some | privileged reason by itself, some privileged perception and some a combination of the two. Reason by itself was privileged by those of the Pythagoreans who argued most strenuously against the *mousikoi* that perception should be expelled altogether, and reason brought in as an autonomous criterion in itself. These people are thoroughly refuted by the fact that they adopt something perceptible at the outset and then forget that they have

⁸⁷ Ptolemy's characterisation of sight and hearing as the servants of reason appears briefly at *Harm.* 5.6–8, quoted above; it is more fully developed at *Harm.* 93.11–94.0.

⁸⁸ On Didymus see 5.11–15 above with n. 13.

- (15) αἰσθησιν προέκριναν οἱ ὀργανικοί, οἷς ἡ οὐδαμῶς ἔννοια θεωρίας ἐγένετο ἢ ἀσθενής. τῶν δὲ τὸ συναμφοτέρον προκρινάντων τίς ἡ διαφορά; οἱ μὲν ὁμοίως ἀμφοτέρα ἰσοδυναμοῦντα παρέλαβον τήν τ' αἰσθησιν καὶ τὸν λόγον, οἱ δὲ τὸ ἕτερον προηγούμενον, τὸ δ' ἕτερον ἐπόμενον. ὁμοίως μὲν ἀμφοτέρα Ἀριστόξενος ὁ Ταραντῖνος. οὔτε γὰρ αἰσθητὸν δύναται
- (20) συστήναι καθ' αὐτὸ δίχα λόγου, οὔτε λόγος ἰσχυρότερός ἐστι παραστήσαι τι μὴ τὰς ἀρχὰς λαβὼν παρὰ τῆς αἰσθήσεως, καὶ τὸ τέλος τοῦ θεωρήματος ὁμολογούμενον πάλιν τῇ αἰσθήσει ἀποδιδούς. τί δὲ μᾶλλον βούλεται προηγῆσθαι τὴν αἰσθησιν τοῦ λόγου; τῇ τάξει, οὐ τῇ δυνάμει. ὅταν γάρ, φησί, ταύτῃ τὸ αἰσθητὸν συνοφθῇ ὁποῖόν ποτέ ἐστι, τότε δεῖν ἡμᾶς
- (25) καὶ τὸν λόγον προάγειν εἰς τὴν τούτου θεωρίαν. τίνες τὸ συναμφοτέρον ὁμοίως Πυθαγόρας καὶ οἱ διαδεξάμενοι. βούλονται γὰρ αὐτοὶ τὴν μὲν αἰσθησιν ὡς ὁδηγὸν τοῦ λόγου ἐν ἀρχῇ παραλαμβάνειν πρὸς τὸ οἰοεῖν ζώπυρά τινα παραδιδόναι αὐτῷ, τὸν δὲ λόγον ἐκ τούτων ὀρμηθέντα καθ' ἑαυτὸν πραγματεύεσθαι ἀποστάντα τῆς αἰσθήσεως, ὅθεν καὶ τὸ σύστημα
- (30) τὸ ὑπὸ τοῦ λόγου εὐρηθὲν τῆς πραγματείας μηκέτι συνάδη τῇ αἰσθήσει, οὐκ ἐπιστρέφονται, ἀλλ' ἐπεγκαλοῦσι λέγοντες τὴν μὲν αἰσθησιν πλανᾶσθαι, τὸν δὲ λόγον εὐρηκέναι τὸ ὀρθὸν καθ' ἑαυτὸν καὶ ἀπελέγχειν τὴν
- (26) αἰσθησιν. τίνες ἐναντίως τούτοις; ἔνιοι τῶν ἀπ' Ἀριστοξένου μουσικῶν, ὅσοι κατὰ μὲν τὴν ἔννοιαν θεωρίαν ἔλαβον, ἀπὸ δ' ὀργανικῆς ἕξεως προκόψαντες. οὗτοι γὰρ τὴν μὲν αἰσθησιν ὡς κυρίαν ἔθεσαν, τὸν δὲ λόγον ὥσπερ ἐπόμενον εἰς μόνον τὸ χρεῖῳδες.”
- (5) Ταῦτα μὲν οὖν τὰ τῆς Κυρηναίας.
Ὁ δὲ Δίδυμος ἐξεργαζόμενος τοὺς τόπους γράφει ταῦτα· “καθόλου

22 τί] τίς ETV¹⁸⁷ 24 συνοφθῇ] συναφθῇ Düring 25–26 τίνες... ὁμοίως vix sanum. <ἀλλ' οὐχ> ante ὁμοίως fortasse supplendum 27 παραλαμβάνειν] λαμβάνειν T 32 τὸ] τὸν g

done so.⁸⁹ The *organikoi*,⁹⁰ by contrast, | privileged perception; they gave either no thought at all or only feeble thought to theory.

What is the difference between those who privilege a combination of the two? Some of them adopted both perception and reason on the same level, as having equal power, while others treated one as the leader, the other as the follower. Aristoxenus of Tarentum adopted both on the same level. For what is perceived cannot be | constituted by itself, divorced from reason, and neither is reason strong enough to establish anything without taking its starting-points from perception, and setting out the conclusion of its theorising in a way that agrees with perception. In what respect does he want perception to be in the lead of reason? In respect of order, not of power. For whenever a perceptible thing, whatever it may be, has been observed by perception, then, he says, we must | put reason in the lead, to reflect theoretically upon it. Who are those who adopt both on the same level?⁹¹ Pythagoras and his successors. For they wish to adopt perception as a guide for reason at the outset to provide it with a spark, as it were, but to treat reason, when it has set out from these starting-points, as working on its own in separation from perception. Hence if the system | discovered by reason in its investigation no longer accords with perception, they do not turn back but lay the blame on perception, saying that it is going astray, while reason has discovered by itself what is correct, and refutes perception. Who are in opposition to these people? Some of the *mousikoi* who follow Aristoxenus, those who conceived themselves as undertaking theoretical enquiry, but who set out from expertise on instruments. For they conceived perception as being authoritative and reason as accompanying it, to be used only when needed.⁹²

[26D]

These then are the words of the woman of Cyrene. | Didymus works through these topics in detail and writes as follows:

⁸⁹ The point is that unless they adopt propositions such as those said to be 'posited by the *mousikoi*' at 23.12–17, their 'rational' science will lack any application to the domain of sounds. It will in effect be merely a branch of pure arithmetic.

⁹⁰ 'Instrumentalists'. Ptolemaïs is probably not referring here to a particular group of specialists in musical theory (for instance those who based their theories on the physical attributes of auloi, criticised at Aristox. *El. harm.* 41.25–43.9), but simply to professional players of musical instruments, who inevitably judged the correct sizes of intervals by ear alone when tuning their instruments or performing. See further n. 94 below.

⁹¹ At this point we would expect Ptolemaïs to ask who they are who adopt both criteria but *not* on the same level, treating 'one as the leader, the other as the follower' in the sense that the former has greater 'power' or authority. The text, I think, must be defective. The answer given (which is a direct repetition of material in the previous quotation from Ptolemaïs at 23.25–24.4) does not fit the question recorded here in the MSS, but it fits the expected question perfectly well; Pythagoras and his followers (unlike the other Pythagoreans mentioned at 25.11–14) do indeed accept that perception has a part to play, but once it has performed its relatively humble task it must submit to the authority of reason.

⁹² These people's approach differs both from that of Aristoxenus himself, and – despite their 'expertise on instruments' – from that of the *organikoi* mentioned at 25.15. Their identity is obscure, but cf. 24.4–6 above with n. 85.

- τοίνυν τῶν ἐπὶ μουσικὴν ἐλθόντων οἱ μὲν αἰσθήσει μόνον προσέσχον τέ-
 λεον παρέντες τὸν λόγον. οὐ λέγω δ' ὡς οὔτοι δίχα τοῦ λόγου τὸ σύνολον
 ἢ οὐχὶ κατὰ λόγους τινὰς ἐνυπάρχοντας τοῖς πράγμασι τὴν αἰσθητικὴν
 (10) κρίσιν ἐποιοῦντο, ἀλλ' ὅτι κατὰ τὸ πλεῖστον δυναμοῦν οὐδαμῶς αὐτοῖς
 ἀπόδειξις ἢ ἐπὶ λόγον ἀναφορά τις ἐγένετο, ἢ ὅλως ἀκολουθητικῆς θεω-
 ρίας φροντίς, μόνη δὲ τῇ διὰ συνηθείας αὐτοῖς περιγεγενημένη αἰσθητικῇ
 τριβῇ ἐπερειδόμενοι ἤρκοῦντο· ἦσαν δ' οἱ τε ὀργανικοὶ ἰδίως τοιοῦτοι
 (15) καὶ οἱ φωνασκικοὶ καὶ ἀπλῶς ὅσοι ἔτι καὶ νῦν συνήθως τῇ ἀλόγῳ τριβῇ
 λέγονται χρῆσθαι. οἱ δὲ τὴν ἐναντίαν τούτοις ὀρήσαντες τὸν μὲν λόγον
 προετίμων κριτὴν, τῇ δ' αἰσθήσει οὐκέτι οὕτω προσεῖχον, ἀλλ' ὅσον ἐς
 ἀφορμὴν μόνον ἐπαρκοῦσιν, τὴν ἀπὸ τῶν αἰσθητῶν, ἵνα ὁ λόγος ἐντεῦθεν
 διατηρῇ. οὗτοι δ' εἰσὶν οἱ Πυθαγόρειοι. λαμβάνοντες γὰρ ἐναύσεις
 (20) τινὰς καθ' ἕκαστον πρᾶγμα τὰ ἐκ τούτων ἐπισυντιθέμενα θεωρήματα
 τῷ λόγῳ καθ' ἑαυτὸν συνιστᾷσιν, οὐκέτι προσέχοντες τῇ αἰσθήσει. διὸ
 καὶ δέδοται αὐτοῖς ποτε, ἡνίκ' ἂν τὰκόλουθον λογικῶς μόνον διατηρῇται,
 ἢ δ' αἰσθησις ἀντιμαρτυρῇ, μηδὲν ὑπὸ τῆς τοιαύτης δυσωπεῖσθαι δια-
 φωνίας, ἀλλὰ πεπειθόσι τῷ λόγῳ τὴν αἰσθησιν ὡς πλανωμένην ἀπελαύ-
 νειν. καὶ τὰ καθωμιλημένα δὲ τοῖς ἀπὸ τῆς ἐμπειρίας ἀναγομένοις προσ-
 (25) δέχονται μόνον, ὅταν μὴ τῷ λόγῳ ἀντιμαρτυρῇ.”

Ἐπιδείξας δὲ διὰ πλείονων τὸ λεγόμενον, οἷς ὕστερον εὐκαιρότερον
 χρῆσόμεθα, ἐπάγει· “ἄλλοι δ' εἰσὶν, οἱ ἀμφοτέρω μὲν τιθέασιν αἴσθη-
 σίν τε καὶ λόγον, ἥδη δὲ τῷ λόγῳ προνομίαν τινὰ ἀποδιδόασιν, ὧν ἔστι
 καὶ Ἀρχέστρατος.”

7 προσέχον T 12 αὐτῆς g περιγεγραμμένη T 13 ἐπερειδόμενοι — οἱ τε] λέγονται χρῆσθαι· οἱ
 δὲ τὴν ἐναντίαν τούτοις Mg 18 διατηρῇ Düring διαιρεθῇ codd. 23 πεπειθόσι Düring πεποι-
 θότι codd. ἀπελαύνων T

In general, then, of those who entered on the study of music, some relied on perception alone, paying no attention at all to reason. I do not mean that they made their perceptual judgements in complete detachment from reason, or without respecting certain rational principles (*logoi*) that are embedded in things, | but that so far as possible they offered no sort of demonstration and referred nothing to reason, and had no thought of a logically coherent theory,⁹³ and were content to rely on the practical, perception-based procedures with which habituation had equipped them. These were, in particular, the *organikoi* and the *phōnaskikoi*,⁹⁴ and in a word those who even now are said to use a non-rational procedure | based on habituation.

Those who set out in the opposite way to them gave reason precedence as the judge, and no longer paid attention to perception in this manner, but only to the extent that it suffices as a starting-point, one that is derived from perceptible things, so that reason can keep watch from there onwards. These are the Pythagoreans. For after borrowing some things [from perception] when addressing each matter, they construct the theorems that are put together from these | on the basis of reason alone, paying no further attention to perception. Hence sometimes, when only what follows rationally is safeguarded and perception bears witness against it, it is open to them to be completely unembarrassed by such discordance, but to put their trust in reason and dismiss perception as going astray. And they accept the things that find favour with people who draw on practical experience | only when they do not bear witness against reason.

After supporting what he has said with further evidence, which I shall use more appropriately later, he adds: 'And there are others who give a place to both perception and reason, but who assign some priority to reason; one of them is Archestratus.'

⁹³ 'Logically coherent theory' represents *akolouthētikēs theōrias*, a theory in which one thing 'follows' logically from another.

⁹⁴ A *phōnaskikos* is someone who engages in *phōnaskia*, voice-training, and in some texts a *phōnaskos* (Latin *phonascus*) is a professional voice-trainer. But in most texts the *phōnaskos* is not the trainer but the person whose voice is being trained, a singer or an orator, for instance, and it is he who is referred to in all passages I have found where the form *phōnaskikos* is used. I conclude that Didymus is not thinking of voice-trainers here (the translation I gave in Barker (1989): 242), but of professional singers whose work depends on constant vocal practice; and in that case their conjunction with *organikoi* makes it likely that the latter are instrumental performers. Cf. n. 90 above. Didymus' point is that their identification of the 'correct' musical intervals is grounded wholly in their practical experience, and not at all in theoretical principles or reasoning. He may have had in mind, among other things, the fact that a prominent ingredient in a singer's vocal exercises was practising scales, repeatedly, from bottom to top and down again (see e.g. Ptol. *Harm.* 105.6–11, Antyllus *apud* Oribasius *Collectiones medicae* 6.10.7, Seneca *Ep. ad Lucilium* 15.4–8), which would have inculcated in him the habit of making each interval in a given type of scale the same size every time he sang it, and of perceiving intervals of exactly those sizes as correct. See further Barker (2008).

- (30) Οὐκ ἀχρεῖον δ' ἂν εἶη παρεκβατικώτερον καὶ τούτου σαφηνίσαι τὸν τρόπον ἕνεκα διορισμοῦ τῶν νῦν ἡμῖν χρειωδῶν. ἀποφηνάμενος γὰρ οὗτος τρεῖς εἶναι τοὺς σύμπαντας φθόγγους, βαρύπυκνον, ὀξύπυκνον,
- (27) ἀμφίπυκνον, βαρύπυκνον μὲν ἀφ' οὗ πυκνὸν ἔστιν ἐπὶ τὸ βαρὺ θεῖναι, ὀξύπυκνον δ' ἐναντίως ἔξ οὗ πυκνὸν ἔστιν ἐπὶ τὸ ὀξύ θεῖναι, ἀμφίπυκνον δὲ τὸν μεταξύ τούτων ἔχοντά φησιν ἐνδέχεσθαι· καὶ ἐν ἐνὶ φθόγγῳ κατέχεσθαι, ἐπειδὴ δυνατόν ἐστι πλείους τάσεις τοῦτον <δέχεσθαι> καὶ
- (5) πλέξαι ἐν αὐταῖς μέλος ἑνὸς εἴδους μενούσης τῆς τάσεως, ὥς <δυνατὸν τὰς ὑπάτας> ἀμφοτέρας καὶ <τὴν> παραμέσσην καὶ τὰς πάσας τοιαύτας ὀξυπύκνους εἶναι φθόγγους, ὥσάν φηι ἐκεῖνος. ἥ συμβαίνει δὴ τοῦτον

31 τρόπον] τόπον p

1 βαρύπυκνον μὲν om. p τό om. T 3 τὸ μεταξύ T τὸν τὸ μεταξύ conl. Düring 4 κατέχεσθαι Düring μετέχεσθαι codd. τοῦτον Düring τοῦτο codd. <δέχεσθαι> add. Düring 5 πλέξαι ἐν Düring πλέξαιεν m πλέξομεν g μέλος om. g ἑνός] τινός V¹⁸⁷ μενούσης τῆς τάσεως Düring μένων τινός οὐσίας ἀπάσας METG μένον τινός οὐσίας V¹⁸⁷ p ὥς Düring οἶον codd. <δυνατὸν τὰς ὑπάτας> add. Düring 6 <τὴν> add. Düring καὶ τὰς πάσας] καὶ τὰ σπάσαι M τοιαύτας Düring ταύτας codd. 7 ὀξυπύκνους εἶναι φθόγγους Düring ὀξύπυκνὸν εἰσι φθόγγος MEV¹⁸⁷ g ὀξύπυκνός ἐστι φθόγγος T τοῦτον Düring τούτῳ mG τοῦτο p

| It would be helpful to digress a little and clarify this man's approach, to the extent that it will assist in outlining things that are useful to us now.⁹⁵ He declared that there are three notes in all, the *barypyknos*, the *oxyppyknos* and the *amphipyknos*. He says that the *barypyknos* is the one from which one can place a *pyknon* on its lower side, the *oxyppyknos*, conversely, is that from which one can place a *pyknon* on its upper side, and the *amphipyknos* is that which takes the position between them.⁹⁶ And each of them is embraced | in a single note, since it is possible for it to <occupy> several pitches, and to weave a melody among them while the form⁹⁷ of the pitch remains one and the same, as <it is possible>⁹⁸ for both of <the *hypatai*> and the *paramesē* and all such notes to be *oxyppyknoi*, or so he says.⁹⁹ Hence it

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⁹⁵ 'This man' is presumably Arcestratus, not Didymus; what follows bears no resemblance to the information about Didymus that we find in Ptolemy (*Harm.* II.13, and the tables in II.14). Porphyry mentions a 'school' of Arcestratus in his opening paragraph (3.6–7), and a contemptuous allusion in Philodemus (*De musica* Book 4, col. 137.13–27 Delattre) locates him securely in the Hellenistic period; but otherwise we know little more about him than can be gleaned from the present passage. Quite possibly he is the Arcestratus to whom Athenaeus attributes a two-book essay *On Auletes* (Ath. 634d). Although Porphyry refers to this paragraph as a digression, it seems likely that he is still relying on Didymus' treatise; some of its difficulties may be due to his attempts at compression and paraphrase. I translate, as best I can, the text printed by Düring, but I am far from convinced that it is correct; see the notes below, and for further discussion see Alexanderson ad loc., Barker (2009c).

⁹⁶ The *barypyknos* would then be the highest note of a *pyknon* and the *oxyppyknos* the lowest. This is very odd. The terms *barypyknos* and *oxyppyknos* are found in several other writers (though they generally use *mesopyknos* instead of Arcestratus' *amphipyknos*). But the places they are assigned are always the other way round, as the words' forms would lead us to expect. A *pyknon* is a structure formed from three notes and two small intervals at the bottom of a tetrachord; *barys* means 'low-pitched', in musical contexts, and *oxys* means 'high-pitched'. Hence in regular usage the *oxyppyknos* is the highest of the three notes in a *pyknon* and the *barypyknos* is the lowest. I cannot explain the peculiarities of the usage attributed here to Arcestratus. A fairly simple pair of emendations would eliminate them, e.g. ὃν πυκνὸν ἔστιν for ἀφ' οὗ πυκνόν ἔστιν at 27.1, with a parallel adjustment at 27.2; these would give the sense we would expect. But then another emendation would be needed in the next sentence (27.5–6), which (with or without Düring's supplements) treats the note *paramesē*, which lies at the bottom of a *pyknon*, as an *oxyppyknos*, in line with the eccentric usage that the present sentence records. Here we might read οἷον ἀμφοτέρως τὰς παρανήτας for the MSS οἷον ἀμφοτέρως καὶ παραμέσῃ; this would indeed be closer to the MSS than the text that Düring prints. Arcestratus would then be using the *paranētai*, the second-highest notes in each of the system's upper tetrachords, as examples of *oxyppyknoi*, which would fit with the normal usage.

⁹⁷ I take the word 'form' to refer to the pitch's musical function (which other writers call its *dynamis*), that is, according to this theory, its character as *barypyknos*, *oxyppyknos* or *amphipyknos*.

⁹⁸ See n. 96 above. But even if the references to the two *hypatai* and to *paramesē* are retained, the addition of δυνατόν ('it is possible') to the text is unnecessary and probably mistaken. Without it the sense would be 'since both of the *hypatai* and the *paramesē* and all such notes are *oxyppyknoi*'. If we adopt instead my suggestion in n. 96, it will be 'as for example both of the *paranētai* and all such notes are *oxyppyknoi*'.

⁹⁹ The theory enunciated here, reducing the number of notes (or their musical 'functions') to three, and representing a sequence of notes with different pitches but with the same position in the *pyknon* as constituted by repetitions of the same note set at different pitches, appears nowhere else in this form. But it seems to be rather closely related to the treatments of notes in the *pyknon* which appear in some Aristoxenian sources, e.g. Aristox. *El. harm.* 69.29–72.28, Cleon. 205.16–206.2 Jan.

- χρησθαι μὲν καὶ τῇ αἰσθήσει κριτηρίῳ, ἐπεὶ δίχα αὐτῆς οὐκ ἂν φανείη
 (10) ἕκαστον τῶν εἰλημμένων, οἷον ὃ τε φθόγγος καὶ τὸ εἶναι τρεῖς ἐν πυκνῷ
 μόνον χώρας αὐτοῦ. βεβαιοῦται γὰρ τοῦτο διὰ τοῦ πυκνὸν πρὸς πυκνῷ
 μὴ τίθεσθαι μήτε ὅλον μήτε μέρος. τὸ μέντοι θεωρήμα ὅλον λογικῶς
 συνήκται· τὰ τε γὰρ τῶν φθόγγων εἶδη, ὅτι τοιαῦτ' ἐστί, λόγῳ θεωρεῖ-
 ται, ἐπεὶ τάξεις εἰσὶ τινες τῆς σχέσεως αὐτῶν· τὸ τε συμπέρασμα, ὡς
 εἰπεῖν, τοῦ θεωρήματος—σοφιστικώτερον ὢν τὸ λέγειν τὸ εἶδος μόνον
 (15) φθόγγου καὶ <τὸ> νοητὸν οὕτως ἀπολιπεῖν αὐτό—δηλὸν ὥς ἐστι λογικὸν
 ὅλον, ὅθεν καὶ οὗτος ὁ τρόπος δεδείχθω ἐντεῦθεν.

- “Λοιπὸς δ' ἐστὶν ὁ τῶν κριτήρια τιθέντων ἐπ' ἴσης ἀμφότερα, τὴν τ'
 αἰσθῆσιν καὶ τὸν λόγον· ὁ δ' αὐτὸς οὗτος ὑπάρχει καὶ τῶν προήγησιν
 ἐνίοτε διδόντων τῇ αἰσθήσει παρὰ τὸν λόγον, ἐν ᾧ καὶ Ἀριστόξενος
 (20) ὑπάρχει. οὗτος γὰρ τὰ μὲν τῶν θεωρημάτων φαινόμενα εἰσάγει τῇ
 ἐμπειρικῇ αἰσθήσει, τὰ δὲ δεικνύμενα τῷ λόγῳ θεωρήματα, καὶ τῶν μὲν
 προτέρων τὴν αἰσθῆσιν μόνην εἶναί φησι κριτήριον, τῶν δ' ὑστέρων τὸν
 λόγον, ἐπαλλαγὴν δ' οὐδαμῶς τούτων γίνεσθαι καὶ ἴσον ἑκάτερον τούτων
 τῶν κριτηρίων δύνασθαι ἐν τῷ ἰδίῳ γένει. ὅταν δὲ τὸ ἐξ ἀμφοῖν συνε-
 (25) στηκὸς θεωρῇται, προηγεῖσθαι μὲν τὴν αἰσθῆσιν, ἔπεσθαι δὲ τὸν λόγον
 τῇ τάξει. ἄρχεσθαι μὲν γὰρ ἡμᾶς ἀπὸ τῶν φαινομένων, τὰ δὲ συμβεβη-
 (28) κότα τῷ λόγῳ ἐπισυνάπτειν ἀκολουθῶς, ὁμολογούμενα τοῖς φαινομένοις
 καὶ οὐδέποτε ἐναντιοστατοῦντα αὐτοῖς. τὸν γὰρ λόγον ἐνταῦθα τὸ μὲν
 φαινόμενον τῇ αἰσθήσει ἀδύνατον αἰτιολογῆσαι. διόπερ τοῦτ' αὐτὸ
 πιστευτέον σχεδὸν εἶναι. τὰ δὲ συμβαίνοντα ἐπισκοπεῖν κατὰ τὸ αἰσθήσει
 (5) ὁμολογούμενον καὶ τὸ ἀποτελεσμα δὲ τοιοῦτον θεωρεῖν, οἷον εἶναι συνᾶ-
 δον πάλιν τῇ αἰσθήσει. διόπερ ἐντέλλεται ἀκριβοῦν μάλιστα ἀμφότερα
 τὰ κριτήρια. τοιαῦτα γὰρ ἂν φησιν ἐρεῖν ἕκαστα, οἷα φαίνεται αὐτῷ

9 εἰλημμένων] εἰρημένων Wallis 10 πυκνόν] πυκνοῦ p 11 τίθεσθαι] διατίθεσθαι T
 15 <τὸ> add. Düring 23 ἀπαλλαγὴ g 24 συνεστηκός Mp

7 οἷα] οἷον p αὐτῷ] αὐτό Mp

turns out that he is using the criterion of perception, since without it none of the things posited would be evident, for instance the note, and there being only three | positions for it in the *pyknon*. For this is confirmed by the fact that neither the whole of a *pyknon* nor a part of it is placed next to a *pyknon*.¹⁰⁰ But the theorem¹⁰¹ is constructed entirely by the use of reason. For the fact that the forms of the notes are of these sorts is grasped through reason, since they are specific orderings of the relation between them.¹⁰² And since it is rather sophistic to speak only of the form | of a note and thus to leave it as something merely intelligible,¹⁰³ what one might call the conclusion of the theorem is obviously based wholly on reason. Let this, then, be our explanation of this approach.

There remains the approach of those who place both of the criteria, perception and reason, on the same level;¹⁰⁴ and the same approach belongs to those who sometimes give precedence to perception over reason, among whom Aristoxenus | is included. For he brings to the judgement of perception those of his theoretical propositions that are perceptually evident, but to that of reason those theoretical propositions that are demonstrated; and he says that perception alone is the criterion of the former kind, while reason is that of the latter. He says that there is no crossing-over between them, and that within its own domain each of these criteria has equal power. But when that which is constituted from both | is under consideration, perception takes the lead and reason follows in order.¹⁰⁵ For he says that we begin from the perceptual phenomena, and attach to them their consequences in accordance with reason, consequences that agree with the phenomena, and hence that it is impossible for reason to give explanations for what is evident to perception, which we are therefore virtually compelled to trust in its own right. But we investigate the consequences in accordance with what agrees | with perception, and reach a conclusion of such a sort that it is once again concordant with perception.

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This is why he instructs us to make both of the criteria as accurate as possible. For he asserts that each thing he will say is of a sort that is evident to

¹⁰⁰ See Aristox. *El. harm.* 62.34–63.5, where a proof of this proposition is offered.

¹⁰¹ I.e. the argument through which Archestratus has drawn his conclusions.

¹⁰² If my interpretation of this difficult clause is on the right lines, Porphyry means that the ‘form’ of a note cannot be directly perceived, since it depends not merely on its audible features but on its relation to others in its environment. Cf. Aristox. *El. harm.* 33.4–9, where the reference is to a note’s *dynamis* (n. 97 above).

¹⁰³ This clause too is problematic; Porphyry seems to mean ‘... to leave it as something that is only an object of thought, without mentioning any of its perceptible features’.

¹⁰⁴ As the sentence that follows this passage makes clear, Porphyry is now quoting again directly from Didymus.

¹⁰⁵ ‘In order’ translates *en taxei*. The sense is that perception is prior in the (temporal) order of the steps through which we move to a conclusion. This thesis is to be distinguished from one that would make it prior in ‘power’ or authority; the contrast is drawn explicitly by Ptolemaïs at 25.23 above.

- διὰ τῆς αἰσθήσεως καὶ οὐδέποτε ὑποτίθεσθαι τι ἀξιοῖ τὸν λόγον, ᾧ μὴ ὁμολογήσει ἢ αἰσθησις. οὐ γὰρ εἶναι λογικὸν μάθημα μόνον τὴν μουσικήν, ἀλλ' ἅμα αἰσθητὸν καὶ λογικόν, ὅθεν ἀναγκαῖον εἶναι μὴ ἀπολείπεσθαι θατέρου τὸν γνησίως πραγματευόμενον, καὶ προηγούμενον τιθέναι τὸ τῇ αἰσθήσει φαινόμενον, εἴπερ ἐντεῦθεν ἔστιν ἀρκτέον τῷ λόγῳ. γεωμέτρῃ μὲν γὰρ ἐνέσται ἐπὶ τοῦ ἄβακος τὸ κυκλοτερές ὑποθεμένῳ ὥς εὐθὺ διανύειν τὸ θεώρημα ἀνεμποδίστως διὰ τὸ ἀφροντιστεῖν τοῦ πεῖσαι τὴν ὄψιν περὶ τοῦ εὐθέος λογικὴν ὕλην διεξάγοντι. μουσικῷ δ' οὐκ ἔσται ὑποθεμένῳ τὸ μὴ διὰ τεσσάρων ὥς διὰ τεσσάρων θεωρησάτι δεόντως, ὅτι προσομολογηθῆναι τοῦτο δέον ἐστὶ τῇ αἰσθήσει καὶ τὸν λόγον τὸ ἀκόλουθον τῷ φανέντι ἐπισυνάπτειν, ὅθεν μὴ κατ' ὀρθὸν τούτου συνοφθέντος τῇ αἰσθήσει καὶ τὸν λόγον διαμαρτήσεσθαι ἀληθοῦς. τοιοῦτος δὲ καὶ ὁ τρόπος τῶν Ἀριστοξενείων κριτηρίων, ὥς σαφές τοῖς ἐγκεχειρηκόσι τῇ πραγματείᾳ τάνδρὸς καὶ μάλιστα ἐξ ὧν αὐτολεξεῖ περὶ κριτηρίου ἐν τῷ προοιμίῳ τοῦ πρώτου τῶν Ἀρμονικῶν στοιχείων προφέρεται. διόπερ ὁ περὶ τῆς διαφορᾶς τοῦ κριτηρίου λόγος τῶν τε Πυθαγορείων καὶ Ἀριστοξένου ἐνταῦθα ἀπηρτίσθω εἰς τὸ ἐντελές (15) ἅμα παριστορηκῶς καὶ τὰς τῶν ἄλλων μουσικῶν γενικώτερον περὶ ταυθ' ὑπολήψεις.”

- Τοιαῦτα μὲν καὶ τὰ τοῦ Διδύμου περὶ τῆς διαφορᾶς τῶν ἀνδρῶν. δόξει δ' ἐξ ὧν αὐτὸς περὶ τῆς Ἀριστοξένου εἴρηκεν αἰρέσεως τῆς αὐτῆς εἶναι δόξης καὶ ὁ Πτολεμαῖος αὐτῷ. οὐκ ἔστι δὲ τοῦτ' ἀληθές. τίθεται (30) μὲν γὰρ κριτήρια τὸν λόγον καὶ τὴν αἰσθησιν, οὐ μέντοι ὡσαύτως τῷ Ἀριστοξένῳ, ἀλλὰ τὸν μὲν λόγον τοιοῦτον ἐγκρίνων μᾶλλον, ὅποιον οἱ Πυθαγόρειοι παρελάβανον, τὴν δ' αἰσθησιν οἷαν Ἀριστοξένος. διὸ καὶ μεικτός τις μᾶλλον ἐξ ἀμφοῖν κατ' ἐκλογὴν τῶν παρ' ἀμφοτέροις ἰδίως εἰρημένων. ὁ δὲ καὶ προϊόντος τοῦ λόγου ἔσται σαφές.
- (29) Νῦν δὲ τὴν λέξιν τοῦ Πτολεμαίου τὴν προκειμένην σαφηνιστέον, ἐν οἷς ἂν ἔχοι ἀσαφείας. τὸ δὲ λεγόμενον περὶ τῶν Πυθαγορείων “μὴδ' ἐν οἷς ἀναγκαῖον ἦν ἅπασιν τῇ τῆς ἀκοῆς προσβολῇ κατακολουθήσαντες” τοῦτ' ἔστιν ἅπασιν τοῖς μουσικοῖς καὶ τοῖς ἄλλοις ἀνθρώποις ἔστιν (5) ἅπασιν ἀνάγκη κατακολουθῆσαι τῇ αἰσθήσει, οἷον περὶ εὐωδίας ἢ δυσωδίας καὶ περὶ γλυκύτητος ἢ πικρότητος καὶ ἐπὶ πολλῶν αἰσθητῶν, μᾶλλον δὲ πάντων ἀναγκαῖον ἅπασιν κατακολουθεῖν τῇ αἰσθήσει. ἀλλ' οἱ Πυθαγόρειοι φησι μὴδ' ἐν οἷς ἦν ἅπασιν ἀναγκαῖον τῇ αἰσθήσει κατα-

9 τὴν μουσικὴν μόνον T 11 καὶ προηγούμενον om. Mg 16 ὥς διὰ τεσσάρων om. g
18 συνάπτειν g 19 συνοφθέντος] συναφθέντος Düring 21 ἐγκεχειρηκόσι G ἐγκεκυρικόσι mp
29 καὶ om. MG

3 προσβολῇ p παραβολῇ mG 4 τοῦτ'] τοιοῦτον m

him through perception, and he never thinks it right for reason to postulate anything with which perception will not agree. Musical science, he says, is not a purely rational discipline | but one that is simultaneously perceptual and rational, and hence that a genuine student must not neglect either of the two, and must place what is evident to perception in the lead, since it is from there that reason must begin. For a geometer can postulate that a curved line on his drawing-board is straight and can then complete his theorem without any obstruction, since he is dealing with a subject-matter in the domain of reason and is not concerned with persuading | the eye about what is straight. But a student of music [a *mousikos*] who postulates that something which is not the interval of a fourth is a fourth cannot consider anything correctly, since it [the interval] must be made to agree with perception, and reason must attach what follows to what is perceptually apparent; and hence when it [the interval] is viewed incorrectly by perception, reason too will go astray from the truth. This, | then, is the character of the Aristoxenian criteria, as will be clear to those who have studied Aristoxenus' work, especially from the points he puts forward about the criterion in his own words in the introduction to the first book of his *Harmonic Elements*.¹⁰⁶ Let that, then, complete our account of the difference between the criterion of the Pythagoreans and that of Aristoxenus, | an account that has also sketched in a more general way the assumptions of other musical specialists about these matters.

These, then, are the sorts of thing that Didymus says about the difference between these men. It will appear from what he says about the Aristoxenian school that Ptolemy is of the same opinion as him [sc. Aristoxenus]. But this is not true. For Ptolemy does indeed posit | both reason and perception as criteria, but not in the same way as Aristoxenus; rather, he accepts reason in a guise more like that in which the Pythagoreans adopted it, and perception more in Aristoxenus' manner. The result, then, is more like a mixture of the two, based on selection among the things characteristically asserted by each of them.¹⁰⁷ This will become clear as the discussion proceeds.

Now we must elucidate Ptolemy's statement which we set out above, some of whose contents are unclear. When he says of the Pythagoreans that 'they did not follow the ear's impressions even in the cases where it is necessary for everyone to do so', he means 'for all students of music [*mousikoi*]'. It is indeed necessary for all other people too | to follow perception, for instance in connection with good and bad smell and sweetness and bitterness; in fact it is necessary for everyone to follow perception in relation to many perceptible things, or rather to all of them. But, he says, the Pythagoreans do not follow perception even in cases where it is

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¹⁰⁶ Didymus must in fact be referring primarily to a passage early in what we know as *El. harm.* Book II, at 33.1–27; cf. also 43.27–44.20.

¹⁰⁷ This picks up a theme emphasised in Porphyry's introductory passage, at 3.13–16, 4.12–16.

- κολουθήσαι, οὐδ' ἐν τούτοις τῇ ταύτης προσβολῇ ἐπεσκεύασαν. ὅπως δὲ
- (10) πολλαχοῦ ταῖς διαφοραῖς τῶν ψόφων λόγους ἀνοικεῖους ἐφήρμοσαν, ὀλίγον προελθὼν ἐπιδείκνυσι. διὰ ταῦτα δὴ καὶ διαβολῆς ἐγένοντο αἵτιοι, τῷ λογικῷ κριτηρίῳ παρὰ τοῖς ἑτεροδόξοις. τίνες δὲ οἱ ἑτεροδόξοι εἴρηται. τοὺς δ' Ἀριστοξενεῖους αἰτιᾶται, ὡς παρὰ τὸν λόγον πεποιηκότας καὶ παρὰ τὰ κατ' αἴσθησιν ἐναργῶς ὑποπίπτοντα. παρὰ λόγον μὲν,
- (15) ὅτι μὴ ταῖς τῶν ψόφων διαφοραῖς τοὺς ἀριθμούς ἐφήρμοσαν· οἱ δ' ἀριθμοὶ εἰκόνες τῶν λόγων· τοῦ γὰρ φέρε διπλασίου λόγου εἰκὼν ὁ δύο πρὸς τὸ ἐν ἀριθμὸς καὶ τοῦ ἡμιολίου ὁ τρία πρὸς τὰ δύο καὶ ἐπὶ τῶν ἄλλων ὡσαύτως. οἱ δὲ Πυθαγόρειοι τὰς τῶν φθόγγων διαφορὰς θεωροῦσιν, ἐν οἷς εἰσι λόγοις καὶ ἀριθμοῖς. οἱ δ' Ἀριστοξένειοι τὰ περιλαμβανόμενα ὑπὸ τῶν φθόγγων διαστήματα καταμετροῦσι καὶ τοῖς διαστήμασι τοὺς ἀριθμούς ἀπονέμουσι παραλόγως, ὡς προελθὼν διὰ πλειόνων ἀποδείξει. τοῦτο μὲν οὖν παρὰ τὸν λόγον αὐτῶν ἀμάρτημα, παρὰ δὲ τὰ ἐναργῆ ἐσφάλθαι φησὶν αὐτοὺς, ὅτι καὶ οὖς τοῖς διαστήμασι παραλαμβάνουσιν ἀριθμούς τοῖς κατὰ τὰς αἰσθήσεις μερισμοῖς οὐχ ὁμολογοῦσιν.
- (25) ἐλέγχει δὲ καὶ τοῦτο διὰ πλειόνων τοῦ λόγου προϊόντος.

γ'

- (27) Αἱ ὀξύτητες καὶ αἱ βαρύτητες αἱ τῶν ψόφων τοῖς Πυθαγορείοις οὐ ποιότητες εἶναι ἐδόκουν, ἀλλὰ ποσότητες. ἐπεὶ γὰρ διαφοραὶ μὲν αὗται ψόφων, παντὸς δὲ ψόφου καὶ πάσης φωνῆς ἀρχηγὸς αἰτία ἡ κίνησις,
- (30) τῶν δὲ κινήσεων ἡ μὲν ταχεῖα, ἡ δὲ βραδεῖα, ταῖς διαφοραῖς ταύταις τῶν κινήσεων τὰς περὶ τοὺς ψόφους διαφορὰς ἀνετίθεσαν. αἰτία δ' ἡ μὲν ταχεῖα φορὰ ὀξύτητος, ἡ δὲ βραδεῖα βαρύτητος. τὸ δὲ ταχὺ καὶ βραδὺ θεωρεῖται ἐν ποσῷ καὶ ὀξύτης ἄρα καὶ βαρύτης ἐν ποσῷ.
- (30) Γράφει δὲ καὶ Ἡρακλείδης περὶ τούτων ἐν τῇ Μουσικῇ εἰσαγωγῇ ταῦτα· “Πυθαγόρας, ὧς φησι Ξενοκράτης, εὗρισκε καὶ τὰ ἐν μουσικῇ διαστήματα οὐ χωρὶς ἀριθμοῦ τὴν γένεσιν ἔχοντα· ἔστι γὰρ σύγκρισις ποσοῦ πρὸς ποσόν. ἐσκοπεῖτο τοίνυν, τίνος συμβαί-

21 ἀποδείξει] ἐπιδείξει T 26 κεφ. γ' Πῶς περὶ τοὺς ψόφους ὀξύτης καὶ βαρύτης συνίσταται T κεφ. γ' εἰς τὸ τῆς τοίνυν ἐν τοῖς ψόφοις διαφορὰς G Ἀρχὴ τοῦ τρίτου κεφαλαίου τῶν πτολεμαίου ἀρμονικῶν εἰς τὸ τῆς τοίνυν ἐν τοῖς ψόφοις διαφορὰς ἐξήγησις p

1 ante περὶ add. καὶ p περὶ τούτων om. G

necessary for everyone to do so, nor do they pay attention to its impressions in these cases; and | a little further on he shows how they often attached inappropriate ratios to the differences between notes. This is why they were responsible for slanders against the rational criterion on the part of people whose opinions differ. Who these people with different opinions are has already been explained.

But he criticises the Aristoxenians on the grounds that their constructions are contrary both to reason and to the clear evidence of perception. They are contrary to reason, | because they did not attach the numbers to the differences between the notes, whereas in fact the numbers are the images of the ratios. For the image of the double ratio, for instance, is the number 2 in relation to 1, that of the hemiolic ratio is the number 3 in relation to 2, and so on for the others. The Pythagoreans study the differences between the notes, in the ratios and numbers in which they consist. But the Aristoxenians | measure the intervals bounded by the notes, and assign the numbers to the intervals, contrary to reason, as Ptolemy will show through several considerations as he proceeds. This, then, is their offence against reason; and he says that they made errors contrary to the evident facts, because the numbers they assign | to the intervals do not agree with the divisions that correspond to <the evidence of> the senses. He will demonstrate this too through several considerations in the course of his discussion.

Chapter 3

The Pythagoreans believed that the high and low pitches of sounds are not qualities but quantities. For since they are different attributes of sounds, and the initial cause of every sound and every voice is movement, | and since some movements are swift and others slow, they associated the difference between sounds with these differences between movements. The cause of high pitch is swift movement, and that of low pitch is slow movement. Swiftness and slowness are understood as quantitative, and hence high and low pitch are quantitative too.

Heraclides, too, writes about these matters in his *Musical Introduction*, [30D] as follows.¹⁰⁸

Pythagoras, as Xenocrates says, also discovered that the intervals in music do not arise without number; for they bring a quantity into a relation with a

¹⁰⁸ Xenocrates fr. 87 Isnardi Parente. Whether this Heraclides is the fourth-century philosopher Heraclides of Pontus or a later writer of the same name is a matter of debate; for discussion see e.g. Gortschalk (1968): 450 and Barker (2009a): 275–78, in which I argue that Heraclides of Pontus may indeed have been the author.

- (5) νοντος τά τε σύμφωνα γίνεται διαστήματα καὶ τὰ διάφωνα καὶ πᾶν ἡρμοσμένον καὶ ἀνάρμοστον. καὶ ἀνελθὼν ἐπὶ τὴν γένεσιν τῆς φωνῆς ἔφη· ‘ὥσεί μέλλει τι ἐκ τῆς ἰσότητος συμφωνον ἀκουσθήσεσθαι, κίνησιν δεῖ τινα γενέσθαι.’ ἡ δὲ κίνησις οὐκ ἄνευ ἀριθμοῦ γίνεται, ὁ δ’ ἀριθμὸς οὐκ ἄνευ ποσότητος. κινήσεως δὲ φησιν εἶδη δύο· τὸ μὲν φορά, (10) τὸ δ’ ἄλλοιωσις. καὶ φορᾶς μὲν εἶδη δύο· ἡ μὲν ἐν κύκλῳ, ἡ δ’ ἐπ’ εὐθύ. καὶ τῆς μὲν ἐν κύκλῳ ἡ μὲν εἰς τόπον ἐκ τόπου φέρεται ὡς ὁ ἥλιος καὶ ἡ σελήνη καὶ τὰ ἄλλα ἄστρα, ἡ δ’ ἐν τόπῳ μένοντι ὡς οἱ κινούμενοι κῶνοι καὶ σφαῖραι περὶ τὸν ἴδιον ἄξονα. τῆς δ’ εἰς εὐθὺ φοράς πλείονά ἐστιν εἶδη, περὶ ὧν οὐκ ἀναγκαῖον νῦν λέγειν. ὑποκείσθω οὖν (15) φησιν, ὅτι ἔστι τις φορά ἡ περὶ τοὺς φθόγγους <εἰς> τόπον ἐκ τόπου, εἰς εὐθὺ ἐπὶ τὸ τῆς ἀκοῆς αἰσθητήριον φερομένη. πληγῆς γὰρ ἔξωθεν προσγενομένης ἀπὸ τῆς πληγῆς φωνὴ φέρεται τις, μέχρις ἂν εἰς τὸ τῆς ἀκοῆς ἀφίκηται αἰσθητήριον. ἀφικομένη δ’ ἐκίνησε τὴν ἀκοὴν καὶ αἰσθην ἐνεποίησεν. ἡ πληγὴ δὲ φησιν ἐν οὐδενὶ χρόνῳ ἐστὶν ἀλλ’ ἐν ὄρῳ χρόνου (20) τοῦ παρεληλυθότος καὶ τοῦ μέλλοντος. οὔτε γὰρ ὅτε προσφέρει τις προσκρούσων, τότε ἐγεννήθη πληγὴ, οὔθ’ ὅτε πέπαυται, ἀλλ’ ἐν τῷ μεταξὺ τοῦ τε μέλλοντος χρόνου καὶ τοῦ παρεληλυθότος ἐστὶν ἡ πληγὴ οἷονεῖ τομὴ τις τοῦ χρόνου καὶ διορισμός. καθάπερ γὰρ φησιν εἰ γραμμὴ τέμνοι τὸ ἐπίπεδον, ἐν οὐδετέρῳ ἐπιπέδῳ ἐστὶν ἡ γραμμὴ, ἀλλ’ ὅρος (25) ἀμφοτέρων ἐστὶ τῶν ἐπιπέδων ἡ γραμμὴ. οὕτω καὶ ἡ πληγὴ οὔσα κατὰ τὸ νῦν ἐν οὐδετέρῳ τῶν χρόνων ἐστὶ τοῦ παρεληλυθότος καὶ μέλλοντος. φαίνεται δὲ φησιν ἡ πληγὴ ἐν χρόνῳ τινὶ γινομένη ἀνεπαισθήτῳ διὰ τὴν τῆς ἀκοῆς ἀσθένειαν, καθάπερ καὶ ἐπὶ τῆς ὀψεως ὀρῶμεν γινόμενον. πολ-

9–10 τὰ μὲν – τὰ δὲ T
18 ἐκίνησε] ἐκείνης T

11 εἰς T e corr. τις ceteri
22 τε om. m 24 ἀλλ’ –

12 μένονται M
25 γραμμὴ om. G

15 <εἰς> add. Wallis
25 κατὰ om. g

quantity. He therefore investigated the conditions | under which concordant and discordant intervals and everything attuned and un-attuned arise. And when he went on to consider the way in which voice¹⁰⁹ arises, he said: 'Thus if something concordant arising from an equality is to be heard, there must have been a movement.'¹¹⁰ Now movement does not occur without number, and number does not occur | without quantity. He says that there are two species of movement; one is alteration¹¹¹ and the other is locomotion. There are also two species of locomotion, one circular and one rectilinear. Of circular movement, one kind travels from place to place, as do the sun and the moon and the other stars, and one does so in a fixed place, as do cones and spheres which revolve around their own axes. Of rectilinear movement there are several species, of which it is unnecessary to speak now.

Let us postulate, then, | he says, that the movement to do with notes is a kind of movement from place to place, travelling in a straight line as far as the organ of hearing. For when an impact has occurred externally, a voice travels from the impact until it arrives at the organ of hearing. When it arrives it moves the hearing and creates a sense-impression in it. He says that the impact occupies no time, but exists in the boundary between time past and time to come. For it is not when someone is setting himself | to strike the blow that an impact has occurred, nor when he has finished, but the impact is in what is between the time to come and the time past, and is as it were a kind of cutting and demarcation of time. Just as when a line cuts a plane, he says, the line is in neither plane but is a boundary | of both the planes, so too, since the impact is at the 'now', it is in neither of the times, neither the one that is past nor the one that is to come. The impact evidently occurs, he says, in a time that is imperceptible because of the weakness of our hearing, just as we see happening in the case of sight.¹¹² For often when

¹⁰⁹ 'Voice' represents *phōnē*, as elsewhere in this translation; but it seems clear that the scope of the enquiries mentioned here include sounds of all kinds.

¹¹⁰ The sentence has close affinities with [Eucl.] *Sect. can.* 148.5–6 Jan, and parts of the sequel are also reminiscent of the Euclidean passage. But cf. n. 110 below. Up to this point the text seems to contain Heraclides' report on what Xenocrates had said about Pythagoras. Like 'discovered' in the first sentence and 'investigated' in the second, the 'said' introducing the statement in quotation marks is in the past tense, and the statement appears to be a remark attributed (rather implausibly) by Xenocrates to Pythagoras himself. It is not clear whether the repeated instances of 'he says' (in the present tense, like 'Heraclides, too, writes' and 'as Xenocrates says', above) inserted in the remainder of this passage refer to Xenocrates or to Heraclides.

¹¹¹ In Greek the term *kinēsis*, 'movement', can refer to change of any sort, and hence alteration in e.g. size or quality can be represented as a form of *kinēsis*.

¹¹² This thesis implies that the impact occupies a duration of time, though one so small as to be imperceptible; and this seems to be incompatible with the preceding statement that the impact occupies no time at all. It is not clear how the writer supposed the two views to be related. We might suppose that the non-durational thesis expresses his real opinion and that the other, introduced by the verb *phainetai*, is merely what 'seems' to be the case; but *phainetai* followed by a participle would normally give the sense expressed in my translation, 'the impact *evidently* occurs . . .' The examples discussed at 30.28–31.14 and the statements at 31.17–21 might encourage the view that the impacts are conceived as having duration, though it is very brief, but the non-durational thesis reappears explicitly at 31.15–16.

λάκεις γὰρ κώνου κινουμένου, στιγμῆς ἐπούσης μιᾶς ἐπὶ τοῦ κώνου λευκῆς

- (31) ἡ μελαίνης, φαίνεσθαι συμβαίνει κύκλον ἐπὶ τοῦ κώνου ὁμόχρουν τῇ στιγμῇ· καὶ πάλιν γραμμῆς μόνης ἐπούσης λευκῆς ἡ μελαίνης τοῦ κώνου κινουμένου, τὴν σύμπασαν ἐπιφάνειαν συμβαίνει [τὴν] τοιαύτην φαίνεσθαι, οἷον ἂν εἴη καὶ τὸ τῆς γραμμῆς χρῶμα, καθ' ὃ μέρος οὐδ' ἐν ἡ στιγμῇ τοῦ
- (5) κύκλου φαίνεται οὐδ' ἐν ἡ γραμμῇ τῆς ἐπιφανείας ἀλλ' ἡ ὄψις τὸ τοιοῦτον διακριβοῦν οὐ δύναται. φησὶ δὲ τὸ τοιοῦτο καὶ περὶ τὴν ἀκοὴν γίνεσθαι. καὶ μᾶλλον ἐν ταράχῳ ἐστὶν ἡ ἀκοὴ ἥπερ ἡ ὄψις. εἰ γὰρ τις φησὶ χορδὴν κατατείνας καὶ κρούσας ἐάσῃ αὐτὴν ἀπηχεῖν, συμβήσεται τινων μὲν ἀκηκοέναι φθόγγων, τὴν δ' ἔτι κινεῖσθαι σειομένην καὶ ἐπὶ
- (10) τὸν αὐτὸν τόπον ἀνακάμψεις ποιεῖσθαι, ὥστε τῇ μὲν ὄψει τὴν κίνησιν τῆς χορδῆς φανεράν μᾶλλον ἢ τῇ ἀκοῇ γίνεσθαι. καθ' ἐκάστην δὲ προσκρουσιν τοῦ ἀέρος τυπτομένου ὑπ' αὐτῆς ἀναγκαῖον ἔσται μᾶλλον αἰεὶ καὶ μᾶλλον τῇ ἀκοῇ προσπίπτειν τινὰ ἤχον. εἰ δὲ τοῦτο φησιν, οὕτως ἔχει, φανερόν ὅτι ἐκάστη τῶν χορδῶν πλείους προῖεται φθόγγους. εἰ
- (15) οὖν ἕκαστος φθόγγος ἐν τῇ πληγῇ γίνεται, πληγὴν δ' εἶναι συμβέβηκεν οὐκ ἐν χρόνῳ ἀλλ' ἐν ὄρῳ χρόνου, δηλὸν ὅτι ἀνὰ μέσον τῶν κατὰ φθογγους πληγῶν σιωπαὶ ἂν εἴησαν ἐν χρόνῳ ὑπάρχουσαι. ἡ δ' ἀκοὴ τῶν μὲν σιγῶν οὐ συναισθάνεται διὰ τὸ μὴ εἶναι κινητικὰς τῆς ἀκοῆς, ἀλλὰ καὶ ἅμα τὰ διαστήματα μικρὰ ὄντα καὶ ἀκατάληπτα τυγχάνειν. συνε-
- (20) χεῖς δ' ὄντες οἱ φθόγγοι ἐνὸς ἤχου ποιοῦνται φαντασίαν παρεκτεινόμενου ἐπὶ ποσὸν τινα χρόνον, καθάπερ καὶ ἡ ἐπὶ τοῦ δινωμένου κώνου γραμμὴ τὴν ἐπιφάνειαν ὁμόχρουν ὅλην ἐποίει φαίνεσθαι, [οὗ] οὐ συναισθανομένης τῆς ὀψεως, ὁπότε καθ' ἕκαστον τόπον συγκινουμένη τῷ κώνῳ φαίνοιτο ἡ γραμμὴ, ἀλλὰ διὰ τὸ
- (25) τάχος τῆς φορᾶς φαντασίαν λαμβανόντων ἡμῶν ἐπὶ πάντα τὰ μέρη τοῦ κώνου κινουμένης τῆς γραμμῆς.” καὶ τὴν μὲν ὅρασιν ἔφασάν τινες ἡγεῖσθαι τῶν λοιπῶν αἰσθήσεων, ὥς κατὰ λέξιν Ἀρχύτας ἐν τῷ Περὶ σοφίας γράφων ᾤδε.

29 κώνου om. T

4 εἴη] ἡ MEg ἡ Düring ἡ codd. 8 ἐάσῃ om. T 20 παρεκτεινόμενον codd. 22 ἐπὶ Düring ἐν τῷ codd. δινωμένου codd. corr. Wallis 23 [οὗ] del. Düring 24 ἀλλὰ Düring ἀλλ' ἡ codd. 25 πάντα τὰ μέρη om. M 26 κινουμένου p

a cone¹¹³ is in motion, and there is one white or black spot on the cone, the result is that there appears to be a circle on the cone, of the same colour as the spot. And again, if there is one white or black line, and the cone is in motion, the result is that the whole surface appears to be of the same colour as is the line, since the spot does not appear to be just one part | of the circle or the line just one part of the surface, but the sense of sight is not capable of attaining accuracy in such a case.

[31D]

He says that the same sort of thing happens in the case of hearing too; hearing, indeed, is in even greater confusion than sight. For if someone stretches a string, he says, and after striking it allows it to resonate, the result will be that he hears certain notes, and that the string still continues its swinging motion, | bending back and forth in the same place, in such a way that the string's movement is more evident to sight than to hearing. With every blow on the air that it strikes a sound (*ēchos*) will necessarily fall on the hearing. But if this is so, he says, it is clear that each of the strings projects several notes.¹¹⁴ Then if | each note occurs in the impact, and if it is the case that the impact does not occupy time but is in a boundary of time, it is obvious that between the impacts corresponding to the notes there must be silences which do occupy time. Hearing does not detect the silences, because they are not capable of moving the hearing, and also because the intervals <of time> are small and imperceptible. | But since the notes are continuous,¹¹⁵ they give the impression of a single sound (*ēchos*) extended over some length of time, just as when the line on the spinning cone makes the whole surface seem the same colour, since our sight does not detect when the line appears at each place as it moves together with the cone, but because of the | swiftness of the movement we receive the impression of it on every part of the cone as the line moves.¹¹⁶

Now some people said that sight takes the lead over the other senses, Archytas, for instance, in his work *On Wisdom*, writing exactly as follows:

¹¹³ The 'cone' of which the writer is thinking is evidently a spinning-top.

¹¹⁴ The writer must mean 'the same note several times'; the 'notes' will not have different pitches. His repeated use of the noun *phthonggos*, 'note', in this context implies that the sound produced by each impact has a definite pitch; and in that case he cannot have adopted the theory of pitch propounded in the *Sect. can.* (another text in which a sustained sound is treated as the product of multiple impacts), where the sound's pitch depends on the rapidity with which the impacts succeed one another, and a single impact, taken alone, can therefore have no pitch at all (see 90.7–23 below). If, as I suspect, 33.10–15 is also derived from the present author, he adopts the common view that a sound's pitch depends on the speed at which it travels from its source.

¹¹⁵ 'Continuous' translates *syncheis*; the sense is evidently that the sequence of notes or impacts is unbroken, and they follow one another in very close succession. The writer cannot mean that they join to form a genuine continuum, since he has told us that there are silences between them. With the theory of multiple impacts expounded here compare 75.14–27 = [Aristotle] *De audib.* 803b–804a, *Probl.* XIX.39, 921a, and cf. n. 114 above.

¹¹⁶ In Düring's edition the quotation ends at 'over some length of time' (31.21), and 31.22 begins a new paragraph (hence the short line in the Greek text of 31.21). I follow Theiler and Alexanderson in connecting the next clause closely with the same sentence, and in thinking that it is probably part of the quotation.

- (32) “Τοσοῦτον διαφέρει σοφία ἐν πάντεσσι τοῖς ἀνθρωπίνοις πραγμάτεσσιν, ὡς ὄψις μὲν αἰσθασίων σώματος, νόος δὲ ψυχᾶς. ὄψις τ’ ἐστὶ γὰρ ἐπιβολεστέρα, καὶ πολυειδεστέρα τῶν ἄλλων αἰσθασίων ἐστὶ καὶ νόος ὕπατος τὸ δέον ἐπικραίνων.”
- (5) Ἐκ δὲ τῶν εἰρημένων σχεδὸν τὰ πάθη ἐκατέρᾳ τῶν αἰσθήσεων ἐναντίως πέφυκεν ἐγγίνεσθαι, λέγω δὲ τῇ ὁράσει καὶ τῇ ἀκοῇ. οὐ γὰρ καθάπερ ἡ ὄρασις ἐκπέμπουσα ἐπὶ τὸ ὑποκείμενον τὴν ὄψιν κατὰ διάδοσιν, ὥς φασιν οἱ μαθηματικοί, τὴν ἀντίληψιν ποιεῖται τοῦ ὑποκειμένου, οὕτω που καὶ ἡ ἀκοή.
- (10) Ἄλλ’, ὥς φησιν ὁ Δημόκριτος “ἐκδοχεῖον μύθων οὔσα μένει τὴν φωνὴν ἀγγείου δίκην” ἡ δὲ γὰρ εἰσκρίνεται καὶ ἐνρεῖ, παρ’ ἣν αἰτίαν καὶ θάττον ὀρώμεν ἢ ἀκούομεν. ἀστραπῆς γὰρ καὶ βροντῆς ἅμα γενομένης τὴν μὲν ὀρώμεν ἅμα τῷ γενέσθαι, τὴν δ’ οὐκ ἀκούομεν ἢ μετὰ πολὺ ἀκούομεν, οὐ παρ’ ἄλλο τι συμβαῖνον ἢ παρὰ τὸ τῇ μὲν ὀψει ἡμῶν
- (15) ἀπαντᾶν τὸ φῶς, τὴν δὲ βροντὴν παραγίνεσθαι ἐπὶ τὴν ἀκοὴν ἐκδεχομένης τῆς ἀκοῆς τὴν βροντὴν.”
- Διὸ δὴ ἐναντίως πεφυκέναι ἐκατέρας. ἡ μὲν γὰρ ὄψις τὰ ἐκτὸς ὀρᾷ ἐπιβάλλουσα αὐτοῖς, ὧν τὴν ἀντίληψιν ποιεῖται, λέγω δ’ ἐπὶ τε μείζονος καὶ ἐλάττονος διαστήματος, καὶ διὰ τοῦτο δόξαν οὐκ ἀπίθανον ἡμῖν
- (20) τοῦ αὐτὴν θεωρεῖν τὰ ἐν σχέσει παρέχει. ἐπὶ δὲ τῆς ἀκοῆς πᾶν τούναντίον πέφυκε γίνεσθαι. οὐ γὰρ μένει τὰ διαστήματα ἐκτός, ὥστε τὴν αἴσθησιν ἐπιβάλλειν αὐτοῖς, ἀλλ’ εἰσρεῖ τῇ ἀκοῇ.

1 ἀνθρωπίνους] ἀνθρώποις p 2 ψυχῆς p 3 αἰσθήσεων p 4 ἐπικραῖνον p 12 in marg. τὴν αἰτίαν δι’ ἣν ἀστραπὴν βροντῆς προαισθανόμεθα T 18 τε om. g 21 ἐκτός Wallis ἐντός Düring

‘Wisdom is superior in all human affairs to the same extent as is sight among the body’s senses and intellect among <the faculties of> the soul. For sight has a better grasp and is more multiform than the other senses, and intellect is the highest authority in fulfilling what is right.’¹¹⁷ | But it seems from what has been said that the experiences (*pathē*) of the two senses – I mean sight and hearing – arise in them in opposite ways. For hearing does not, like sight, get its grasp on the object through ‘communication’ (*diadosis*) with it, as the mathematical theorists put it, by sending the sight out to meet the object. | Instead, as Democritus says, ‘it is a receptor of utterances which awaits the voice like a vessel. For the voice is distributed into it and flows in; and for that reason we see more quickly than we hear. Thus when lightning and thunder occur simultaneously we see the lightning at the same time as it occurs, but we either do not hear the thunder or hear it after a long time; and this is for no other reason than that the light | meets with our sight, whereas the thunder comes to the hearing, and the hearing receives the thunder.’¹¹⁸ Thus the two are constituted in opposite ways. For sight sees external things by impinging on the objects of which it provides perception, impinging, I mean, at both greater and smaller distances (*diastēmata*),¹¹⁹ and therefore gives us the convincing belief | that it is viewing things as they really are. But the situation is quite the opposite in the case of hearing. For the distances (*diastēmata*) do not remain outside so that the sense impinges on them, but flow into the ear.

¹¹⁷ It is generally agreed that the essay *On Wisdom* is not by Archytas, but dates from the Hellenistic period. See Huffman (2005): 598–9. The present excerpt also appears (in a slightly different version) as part of the first of five passages quoted in Iamblichus *Protrepticus*, printed in Thesleff (1965): 43.24–45.4.

¹¹⁸ Democritus test. 126a DK. In this passage too, references to ‘voice’, *phōnē*, should evidently be understood as including sounds of all kinds. For Democritus’ theory of sight see Theophrastus *De sens.* 49–57 (test. 135 DK); it involves the confluence of emissions from the object and from the eye in the air between them, and seems to have formed the basis of the theory elaborated by Plato at *Tim.* 45b–46c.

¹¹⁹ The noun *diastēma* refers, in general, to the distance by which any two items are separated, and its musical sense, ‘interval’ (the ‘distance’ between two notes), is a special case of this usage. In the statement about sight, the *diastēmata* must be either the distances between the eye and the perceived objects or the distances between the objects themselves. Then in order to make the contrast convincing, the *diastēmata* connected with hearing in the last sentence of the paragraph should be the distances between the ear and the sources of sounds, or those between various sound-sources. (For discussion of the way in which the ear judges the distance between itself and the source of a sound see [Aristotle] *De audib.* 801a–b, quoted at 70.1–18 below.) In the broader context of the passage, however, we would expect these *diastēmata* to be musical intervals, since (as is made explicit in the subsequent quotation) what is relevant here is the ear’s unreliability in assessing relations between notes, not in assessing distances between objects in space. Porphyry seems to be exploiting the semantic ambiguity rather than mounting a cogent and continuous argument.

- “Θεωρῶν οὖν τὰς αἰσθήσεις μὴ ἐστώσας ἀλλ’ ἐν ταραχῷ οὔσας καὶ τὸ ἀκριβές μὴ καταλαμβανούσας ἐπειράθη λόγῳ τινὶ ἐστῶτι συνιδεῖν τὴν τῶν φθόγγων ἀρμογὴν. ἐπεὶ γὰρ τῶν φωνῶν αἱ μὲν εἰσιν ἐκμελεῖς, αἱ δ’ ἐμμελεῖς· ἐκμελεῖς μὲν ὅποσαι τραχύνουσι τὴν αἴσθησιν ἡμῶν ἢ ἀνομάλως κινουσί· καθάπερ ὁσφρησιν τὰ δυσώδη καὶ ὄσιν τὰ τοῦ αὐτοῦ γένους ὀρατά, οὕτω δὴ καὶ ἀκοὴν πάντα τὰ τραχέα καὶ ἐστερημένα τοῦ προσηνοῦς. ἐμμελεῖς δ’ εἰσὶ φωναὶ αἱ προσηνεῖς τε καὶ λεῖαι. δείκνυται δ’ ὅτι πᾶσα φωνὴ κατ’ ἀριθμὸν κινεῖται· καὶ ἔστι κοινὸν μὲν αὐτῆς ἢ κατ’ ἀριθμὸν κίνησις, ἴδιον δὲ τῆς μὲν τὸ ἐκμελές, τῆς δὲ τὸ ἐμμελές. σκοπεῖν οὖν χρή, τίνος προσγενομένου τοῖς ἀριθμοῖς τὸ τοιοῦτον ἐπισυμβαίνει ταῖς φωναῖς. ἐπεὶ οὖν συμφωνεῖ τοῖς ἀριθμοῖς οὐδ’ ἄλλο ἢ ὁ λόγος· λόγου ἄρα προσγενομένου τῇ τῶν φωνῶν κινήσει γίνεται τὸ ἐμμελές. καὶ οὕτως ἂν τις ἐπιδείξειε παρὰ τὴν τοῦ λόγου αἰτίαν συμβαῖνον τὸ εἰρημένον.”
- (5) Ἐν δὴ τούτοις εἴρηται μὲν ἡ αἰτία, δι’ ἣν οἱ Πυθαγόρειοι τὴν ἀκοὴν πρὸς τὰς κρίσεις τῶν συμφώνων παρητοῦντο, τῷ δὲ λόγῳ μόνῳ μόνον προσεῖχον. εἴρηται δὲ καί, πῶς συνεχεῖς ὄντες οἱ φθόγγοι ἐνὸς ἤχου ποιοῦνται φαντασίαν παρεκτεινομένου ἐπὶ ποσὸν τινα χρόνον διὰ τὸ τάχος τῆς φορᾶς οὐ συναισθανομένης τῆς ἀκοῆς, ὅποτε καθ’ ἕκαστον φθόγγον συγκινούμενος τῷ φθόγγῳ ὁ ἤχος φαίνοιτο. ταχείας μὲν οὖν καὶ πυκνοτέρας τῆς φορᾶς γινομένης ὁξὺς γίνεται ὁ ψόφος, βραδείας δὲ καὶ χαλαρωτέρας βαρὺς. ὅπερ γὰρ αἱ ἐπιτάσεις καὶ αἱ ἀνέσεις τῶν χορδῶν, τοῦτο αἱ ταχυτῆτες καὶ βραδυτῆτες ποιοῦσιν· ἡ δ’ ἐπίτασις ὁξυτέραν ἐποίει πρὸς φθόγγον καὶ ἡ ἀνεσις βαρυτέραν, ὥστε καὶ αἱ ταχυτῆτες (15) ὁξυτέραν καὶ αἱ βραδυτῆτες βαρυτέραν τὴν ἡχὴν ἀποτελοῦσι.

32 προγενομένου T

1 ὁ om. g 6 μόνον om. T 9 φορᾶς] φωνῆς Mg 14 ἀνεσις Wallis διαίσεις codd.
15 ὁξυτέραν καὶ αἱ βραδυτῆτες om. T

Understanding, then,¹²⁰ that the senses are not stable but confused, and that they have no grip on accuracy, he tried to understand through some stable form of reason how | notes are fitted together.¹²¹ For some of the notes are un-melodic and some are melodic.¹²² The un-melodic are those that roughen our sense-faculty or move it unevenly; just as unpleasant odours affect the faculty of smell and visible things of the same sort affect that of sight, so everything rough and lacking in gentleness affects the hearing. The melodic notes are those that are gentle and smooth. It is a proven fact | that all voice moves in correspondence with number, and movement in correspondence with number is something common to it; whereas the un-melodic is characteristic of one <kind of> movement and the melodic of another. One must therefore enquire what condition has been produced among the numbers when this sort of attribute supervenes upon the voices. [33D] Now since nothing except ratio (*logos*) between numbers is concordant, it is therefore when a ratio has been produced in the movement of the voices that the melodic comes into being. And in this way one can show that ratio¹²³ is the cause through which the attribute we have mentioned arises.

| These remarks, then, have explained why the Pythagoreans rejected hearing as a means of judging the concords, and concentrated on reason alone. They have also explained how a continuous succession of notes creates the impression of a single sound (*ēchos*) extended for some length of time, since because of the speed of their movement the hearing does not detect the movements when the sound (*ēchos*) appears, | moved together with the note each time a note occurs. Thus when the movement is swift and more compacted the sound (*psophos*) is high pitched, and when it is slow and more diffuse it is low pitched. For the swiftesses and slownesses do the same thing as the tensenesses and slacknesses of strings. Tenseness makes the sound (*ēchē*) of the note higher pitched and slackness makes it lower, so that swiftesses also | result in the sound (*ēchē*) being higher and slowness in its being lower.¹²⁴

¹²⁰ I set this paragraph as a quotation, since it is almost certainly a continuation of Heraclides' report on the work of Xenocrates. To judge from the tense of 'he tried', it would appear to be another part of Xenocrates' imaginative reconstruction of the work of Pythagoras; cf. n. 110 above.

¹²¹ The Greek uses a noun, *harmogē*, a 'fitting together', which is cognate with such words as *harmonia*; literally, 'he tried to understand . . . the fitting-together of notes'.

¹²² Strictly speaking, the writer should have referred here to sequences or combinations of notes; a single note in isolation is neither melodic nor unmelodic. But perhaps we may treat his form of expression as an intelligible shorthand, clarified by the preceding allusion to 'fitting notes together'.

¹²³ Or possibly 'reason'. Since the meaning of *logos* is clearly 'ratio' in the preceding sentence, it is probably so here too; but compare Porphyry's statement at the beginning of the next paragraph, where *logos* must be 'reason'. With these remarks cf. the rather more sophisticated account of Adrastus *apud* Th. Smyrn. 50.12–21.

¹²⁴ I suggest, though with some hesitation, that the last three sentences of this paragraph are also quoted or paraphrased from Heraclides, though the first two sentences are certainly not.

Πεπείραται δὲ καὶ Αἰλιανὸς ἐν τῷ δευτέρῳ τῶν Εἰς τὸν
Τίμαιον ἐξηγητικῶν παραστήσαι τὸ τοιοῦτον, οὗ τὴν λέξιν
παραγράψομεν ἔχουσιν οὕτως.

- “Αἱ δὲ φωναὶ διαφέρουσιν ἀλλήλων ὀξύτητι καὶ βαρύτητι. ἴδωμεν
(20) οὖν, τίνες εἰσὶ τῆς διαφορᾶς τῶν φθόγγων ἀρχηγοὶ αἰτίαι. πάσης δὴ
φωνῆς ἀρχηγὸς αἰτία ἐστὶν ἡ κίνησις. εἴτε γὰρ ἐστὶ φωνὴ ἀπὸ πεπληγ-
μένος, ἡ πληγὴς κίνησις ἐστὶν, εἴτε, ὥς <οἱ> Ἐπικούρειοι θέλουσι, τὸ τῆς
ἀκοῆς αἰσθητήριον <κίνησιν δέχεται> ἀπὸ τῶν φωνῶν, τῆς παρὰ φωνῆς
παραγινομένης
ἐπὶ τὸ τῆς ἀκοῆς αἰσθητήριον ἐκ τινῶν ῥευμάτων, καὶ οὕτως ἡ κίνησις
(25) αἰτία γίνεται τοῦ πάθους. τίς οὖν ἡ περὶ τὴν κίνησιν διαφορὰ θεωρήσω-
μεν καὶ ποία κίνησις τῆς τοιαύτης φωνῆς αἰτία, καὶ ποία τῆς τοιαύτης
τοῖς οὖν φαινομένοις τὰ πρῶτα προσέχοντες οἱ πρὸ ἡμῶν καὶ λαβόντες
ἀπὸ τούτων τὴν καταρχὴν τὸ ζητούμενον ἐπορίσαντο. ἡύρισκετο γὰρ
τῆς μὲν ὀξείας φωνῆς ἡ ταχεῖα κίνησις αἰτία, τῆς δὲ βαρείας ἡ βραδυτής.
(30) καὶ τοῦτο συνιδεῖν ἐστὶν ἐπὶ τῶν φαινομένων ταῖς αἰσθήσεσι τοῦ συμβαί-
νοντος. ἐὰν γὰρ αὐλοὺς λάβῃ τις δύο ταῖς εὐρύτησι τῶν κοιλιῶν ἴσους
καὶ τῷ αὐτῷ πνεύματι χρησάμενος ἐμφυσήσῃ ἀπὸ μιᾶς δυνάμεως τοῦ
(34) πνεύματος, ἑξακουσθήσεται διὰ μὲν τοῦ μείζονος αὐλοῦ βαρύτερος φθόγ-
γος, διὰ δὲ τοῦ ἐλάσσονος ὀξύτερος. καὶ φανερόν, ὅτι—τοῦ πνεύματος
διὰ μὲν τοῦ ἐλάσσονος τάχιον διαθέοντος καὶ τὸν παρακείμενον ἄερα
πλήξαντος, διὰ δὲ τοῦ μείζονος βράδιον τὸν ἐν τῷ μακροτέρῳ αὐλῷ
(5) περιεχόμενον ἄερα προώσαντος—κατὰ λόγον ὀξύτερος μὲν ὁ φθόγγος
διὰ τοῦ τῷ μεγέθει μικροτέρου αὐλοῦ γίνεται, βαρύτερος δὲ διὰ τοῦ

22 ante ὥς add. καὶ T <οἱ> add. Düring Ἐπικούρειοι Wifstrand Ἐπικούριοι Düring

23 <κίνησιν δέχεται> Sedley per litteras παρὰ φωνῆς Sedley παραφωνῆς codd. 26 φωνῆς om. T

29 βαρείας] βραδείας T 30 ξυνιδεῖν T

2 ὀξύτερος — 3 ἐλάσσονος om. T 6 βαρύτερος scripsi βραδυτέρος codd.

Aelianus too has tried to establish this sort of conclusion in the second book of his *Commentaries on the Timaeus*.¹²⁵ We shall transcribe his words, which are as follows.

Voices differ from one another in height and depth of pitch. Let us see, | then, what the fundamental causes of the difference between notes are. The fundamental cause of all voice is movement. For if voice is air that has been struck, the impact is a movement, and if, as the Epicureans would have it, the organ of hearing receives a movement from the voices, when the movement derived from the voice reaches the organ of hearing borne on certain currents, in this way too | the cause of the experience is a movement.¹²⁶ Let us investigate, then, what difference there is in respect of movement, and what sort of movement is the cause of one sort of sound and what sort is the cause of another. Our predecessors paid attention, first of all, to the perceptible phenomena, and having taken their starting-point from them they provided the answer we are seeking. For they found that the cause of a high voice is swift movement, and that of a low voice is slowness; | and this can be observed by anyone, in things that are apparent to the senses. For if one takes two *auloi*, equal in the width of their bores, and blows into them using the same breath, from breath of one and the same power there will be clearly heard a lower note through the larger *aulos* and a higher note through the smaller. Since the breath runs through the smaller and strikes the surrounding air more swiftly, while it does so more slowly through the bigger one as it pushes forward | the air contained in the larger *aulos*, it is evident that the note through the *aulos* that is smaller in size is proportionately higher, and

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¹²⁵ The work may have been a broadly based study of the *Timaeus* rather than a formal commentary. The writer may possibly be Claudius Aelianus (second to third century AD), who abandoned his career as a sophist to write copiously on divine providence and the marvels of the animal kingdom. But he is not known as a serious philosopher; we have no evidence to confirm that he wrote on the *Timaeus*, and his allusions to Plato in his surviving works are typically anecdotal rather than philosophical. By contrast, the writer whom Porphyry is quoting is described at 91.12 and 96.7 as 'Aelianus the Platonist'; and it seems likely that Porphyry added 'the Platonist' to his name precisely in order to distinguish him from the better-known figure. Other such designations in the commentary (e.g. 'Didymus the music specialist', 'Panaetius the younger') seem to be similarly motivated. On the other hand a phrase at 35.11 below might suggest that Porphyry's Aelianus also wrote works characteristic of a sophist. If he is not Claudius Aelianus, we know nothing about him beyond what can be gleaned from Porphyry's quotations.

¹²⁶ I am grateful to David Sedley for helping me with this difficult sentence. He pointed out, correctly, that what the MSS present as a single noun in the genitive, *paraphōnēs*, is impossible as a noun; no such formations with *-phōnē* exist in Greek. We must read it as two words, *para phōnēs*, 'derived from the voice'. In that case a supplement of the sort he suggests ('receives a movement') is needed to complete the syntax. I have slightly modified the translation he offered. Aelianus is referring to the Epicurean view that when someone speaks, for instance, or two stones are banged together, a stream of atoms passes through the air from the source and enters the ear, where its movement stimulates the hearing. See Epic. *Ep. ad Hdt. apud* Diog. Laert. X.52–3, where the stream of atoms is again called a 'current' or 'stream' (*rheuma*). Cf. also Lucretius IV.524–614.

- μακροτέρου. καὶ αἱ σύριγγες δὲ τοῦτο ἐναργῶς δηλοῦσιν, ὅταν ἐξ ἀνίσων μὲν τοῖς μήκεσι μεγεθῶν γένωνται οἱ αὐλίσκοι, ἴσων δὲ ταῖς τῶν κοιλιῶν εὐρύτησιν. ὁ γὰρ μικρότερος τῷ μήκει αὐλίσκος ὀξύτατον φθόγγον
- (10) ἀποτελεῖ, ὁ δὲ μέγιστος βαρύτερον, οἱ δὲ μεταξύ ἀναλογούντως ἀπηχοῦσι. πάλιν δ' ἐὰν λάβῃς δύο αὐλοὺς τοῖς μὲν μήκεσιν ἴσους, ταῖς δ' εὐρύτησι τῶν κοιλιῶν διαφέροντας, καθάπερ ἔχουσιν οἱ Φρύγιοι πρὸς τοὺς Ἑλληνικούς, εὐρήσεις παραπλησίως τὸν εὐρυκοιλίον ὀξύτερον προῖε-
μενον φθόγγον τοῦ στενοκοιλίου. θεωροῦμέν γέ τοι τοὺς Φρυγίους στε-
(15) νοὺς ταῖς κοιλίαις ὄντας καὶ πολλῷ βαρυτέρους ἤχους προβάλλοντας τῶν Ἑλληνικῶν. καὶ ἐπὶ τούτων οὖν τὸ τάχος τῆς κινήσεως αἴτιον. ἐπὶ μὲν γὰρ τῶν στενοπόρων δυσοδοῦντος τοῦ πνεύματος καὶ τῇ μικρότητι τοῦ πόρου θλιβομένου βραδυτέρα κινήσις αὐτοῦ γίνεται, ἐπὶ δὲ τοῦ εὐρυ-
τέρῃ τῇ κοιλίᾳ κεκρημένου, ἅτε δὴ μηδεμιᾶς ἐγκοπῆς γινομένης ἢ διέ-
(20) ξοδος τοῦ πνεύματος ταχύτερα συμβαίνει. καὶ ἐφ' ἐνὸς αὐλοῦ ταῦτο κατανοῆσαι δυνατόν ἐστι. τὰ γὰρ τρήματα πρὸς γένεσιν ὀξέων καὶ βαρέων φθόγγων μεμηχάνηται· τὰ γὰρ ἐγγυτάτω τῆς γλωσσίδος τρήματα, τουτέστι τ' ἀνωτάτω, τάχιον τοῦ πνεύματος δι' αὐτῶν εἰς τὸν ἐκτὸς ἀέρα ἐκπίπτοντος, ὀξύτερος ὁ φθόγγος γίνεται, διὰ δὲ τῶν πορρωτέρω τρη-
(25) μάτων βαρύτερος ὁ φθόγγος ἀποτελεῖται, δι' οὖν τῶν κατωτάτω τρημάτων βαρυτάτος, ὅθεν ἐὰν βουλευθῶσιν ὀξύτερον ἀποτελεῖσαι φθόγγον, τὰ μὲν ἀνωτέρω τρήματα ἀνοίγουσι, τὰ δὲ κατώτερα κλείουσιν, ἐὰν δὲ βαρύτερον, τὸ ἐναντίον ποιοῦσι. καὶ ἐπὶ τῶν ἐνταῶν δ' ὀργάνων τὸ αὐτὸ παρέσται σκοπεῖν. οἱ γέ τοι παλαιοὶ τὸ τρίγωνον, ὃ δὴ καλεῖται
(30) σαμβύκη, ἐξ ἀνίσων τοῖς μήκεσι χορδῶν ἐποίησαν, μακροτάτης μὲν τῆς πασῶν ἐξωτάτω, ὑποδεεστέρας δὲ ταύτης τῆς πλησίον, τῶν δ' ἔτι ἐνδοτέρων καὶ πρὸς τῇ γωνίᾳ τοῦ ὀργάνου καθημένων κολοβωτέρων τοῖς μήκεσιν· ἰσοπαχεῖς δ' ἐποιοῦν τὰς χορδὰς. οὐ γὰρ ἥδεσάν πω τὰς τῶν
(35) παχέων διαφοράς. διὸ καὶ συνέβαινε τὰς μὲν μικροτέρας χορδὰς πληττομένας ὀξύτερον ἀποτελεῖν τὸν φθόγγον, τὰς δὲ μακροτέρας βαρύτερον. ἐπὶ μὲν γὰρ τῶν μακροτέρων χορδῶν [φθόγγων] βραδεῖα τε γίνεται ἢ ἀντίστας καὶ ὁμοίως βραδίων ἢ μετὰ τὴν πληξιν ἀποκατάστας, ὅθεν
(5) ὁ ἄηρ βράδιον ὑπὸ τῆς χορδῆς πληττόμενος βαρὺν ἀποτελεῖ τὸν φθόγγον. ἐπὶ δὲ τῶν βραχυτέρων χορδῶν ταχεῖα γίνεται ἢ τε πληξίς καὶ ἡ ἀπο-

10 ἀναλογούντας g ὑπῆχοῦσι M ἀποχοῦσι T 22 μεμηχάνηται] μηχανήματα g ἐγγυτάτω
Düring ἐγγύτατα τῷ codd. τρήματα] τρώματι T 24 διὰ — 25 ἀποτελεῖται om. T
25 βαρύτερος — τρημάτων om. g 29 δὴ om. G ὃ δὴ καλεῖται σαμβύκη om. p σαμβύκη G
τὸ τρίγωνον ὄργανον καμβύκη καλεῖται in marg. T

3 [φθόγγων] del. Düring 4 ἀντίστας T

that through the larger is lower.¹²⁷ Panpipes (*syringes*) show this clearly too, when the little pipes (*auliskoî*) are made in sizes unequal in length but equal in the width of their bores. For the little pipe that is smallest in length | produces the highest note and the largest produces the lowest, while those in between emit sounds in proportion.¹²⁸ Again, if you take two *auloi* that are equal in length but differ in the width of their bores, as do Phrygian *auloi* in relation to Greek ones, you will find in the same way that the wide-bored *aulos* projects a higher note than the narrow-bored. We see, at any rate, that Phrygian *auloi* | with their narrow bores send out much lower sounds (*ēchoî*) than Greek *auloi*. In these <instruments> too the cause is the speed of movement; for since in those with a narrow passage the breath travels with difficulty, impeded by the smallness of the channel, its movement is slower, while in the one with a wider bore, since there is no obstruction, | the breath's journey through to the outside is swifter. The same thing can be observed on just one *aulos*, for the finger-holes have been devised to produce high and low notes. For since the breath emerges more swiftly into the outside air through the finger-holes closest to the mouthpiece, that is, those furthest up <on the instrument>, the note is higher, while the note through the more distant finger-holes | is lower; and thus the note through the holes furthest down <the instrument> is the lowest. Hence if people want to produce a higher note they open the upper finger-holes and close those further down, and if they want to produce a lower note they do the opposite.

The same thing can be observed on stringed instruments too. For the ancients made the *trigōnon*, which is also called | the *sambykē*,¹²⁹ with strings of unequal lengths, with the longest of all on the outside, the one shorter than it next to it, while those still closer to the inside, lying near the angle of the instrument, were still more curtailed in size. They made the strings equal in thickness, for they did not yet understand about differences in thickness. The result was that when the shorter strings were struck they produced a higher note, and the longer ones a lower note. For in the longer strings the displacement is slow, and the recoil after the stroke, similarly, is also slower. Thus since | the air is struck more slowly by the string it produces a low note. In the shorter strings the stroke and the recoil are

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¹²⁷ Or, with the reading of the MSS, 'is slower'.

¹²⁸ I.e. in proportion to their lengths. 'Emit sounds' translates *apēchousin*, cognate with the noun *ēchos*; it implies that what the pipes emit are *ēchoi*. The Panpipes to which Aelianus refers are of the sort generally used in Hellenistic and Roman times, with pipes graduated in length like those of their modern counterparts. On the earlier Greek instrument the pipes were all the same length, but were plugged to varying depths with wax. See e.g. West (1992): 109–12.

¹²⁹ The *trigōnon* is a triangular harp. This passage shows that the name *sambykē* could be applied to a kind of harp, but this may not be its original use; the identity of the instrument to which it referred has been the subject of some debate. See especially Landels (1966), West (1992):

75–7.

- κατάστασις. ὕστερον δ' ἐπενοήθη ἐπὶ τῶν ἰσομηκῶν χορδῶν <διά> τὴν τῶν παχέων διαφοράν τὸ τάχος τῆς κινήσεως διὰ μὲν τῶν παχυτέρων χορδῶν βράδιον γίνεσθαι, διὰ δὲ τῶν λεπτομερῶν θάσσον. καὶ δι' ἄλλων δὲ πολλῶν τὸ αὐτὸ παραστήσαι δυνάμενος, ἵνα μὴ τὴν γραφὴν ἐπιμήκη ποιῶ, ἀρκεθήσομαι τοῖς εἰρημένοις. ἐν γὰρ τοῖς τοπικωτέροις ἀκριβῶς πάντα δεδήλωται ἡμῖν.

- Τῆς οὖν ταχείας κινήσεως αἰτίας οὔσης τοῦ τὸν φθόγγον ὀξύν ἀποτελεῖσθαι, τῆς δὲ βραδείας βαρύν, συμφανές, ὅτι ὁ ὀξύς φθόγγος ἀπὸ τοῦ βαρυτέρου [διάστημα] ἀφέστηκεν, καὶ ἡ διαφορά τοῦ ὀξύτερου παρὰ τὸν βαρύτερον φθόγγον καὶ τοῦ βαρυτέρου παρὰ τὸν ὀξύτερον καλεῖται διάστημα, ἐπεὶ [δ'] οὐ πᾶς ὀξύς φθόγγος καὶ βαρὺς κατὰ τὸ αὐτὸ κρουόμενοι σύμφωνον ἀποτελοῦσιν, ἀλλ' οἱ μὲν αὐτῶν ἔχουσι τὸν ἕτερον ἐπικρατοῦντα, ὥστε καὶ τὴν ἀκοὴν ἀντιλαμβάνεσθαι τοῦ τ' ἀσυμφώνου κράματος καὶ τοῦ συμφώνου, διόπερ ἡμῖν ἡ διαφορά τοῦ ὀξύτερου φθόγγου παρὰ τὸν βαρύτερον διάστημα καλεῖται. καὶ οὕτως ὀρίζεται τὸ διάστημα дуεῖν φθόγγων ἀνομοίων ὀξύτητι καὶ βαρύτητι διαφέρον. καὶ οὐ πάντως τὸ διάστημα καὶ συμφωνίαν ἔχει. δυνατὸν δὲ γε διάστημα τι ἅμα καὶ σύμφωνον εἶναι, ὥστ' εἰ μὲν τί ἐστι σύμφωνον, τοῦτο καὶ (25) διάστημα περιέχει, εἰ δὲ τί ἐστι διάστημα, οὐ πάντως ἐστὶ σύμφωνον. συμφωνία δ' ἐστὶ дуεῖν φθόγγων ὀξύτητι καὶ βαρύτητι διαφερόντων κατὰ

7 ἰσομήκων **m** <διά> add. Alexanderson
om. **Tr** 15 [διάστημα] del. Höeg 1934
ἐπικρατοῦντα fortasse <οἱ δ' οὐ> addendum

8 παχέων] ταχέων **T** 14 βαρύν] βαρύν **g** ὁ
17 [δ'] deleti 18 ἀποκρατοῦντα **T** 19 post
24 μὲν τι] μέντοι **p**

swift.¹³⁰ They later came to understand that because of the difference in thickness in strings of equal length, the speed of the movement made by the thicker strings is slower, and that made by the thinner ones is swifter. I could exhibit the same thing | on the basis of many other examples; but I shall rest content with those mentioned, in order not to make my essay too long, since I have described all these examples accurately in my more popular writings.¹³¹

Since swift movement is the cause of a high note being produced, and slow movement of a low note, it is clear that the high note | is separated from the lower note, and what distinguishes a higher note by comparison with a lower, and a lower note by comparison with a higher, is called an interval (*diastēma*); for not every high and low note when played simultaneously produce a concord, but in some cases one or the other predominates, so that our hearing apprehends both discordant | and concordant mixtures,¹³² and for this reason we call what distinguishes a higher note from a lower an interval.¹³³ The interval is defined in this way: as the difference between two notes that are unlike in height and depth; and an interval does not always possess concordance too.¹³⁴ But it is possible for something to be an interval and at the same time concordant too, so that if something is concordant it is also | contained by an interval, but if something is an interval it is not always concordant. A concord is the coincidence and blending of two notes

¹³⁰ The idea is that when the string is plucked, its initial movement (*antistasis*, translated above as 'displacement') makes a 'stroke' (*plēxis*) which strikes the air; and when it swings back after this first moment of impact, its 'recoil' (*apokatastasis*) brings it up against the surrounding air again, making a second impact. The process will continue, producing a sound each time, until the string returns to rest; the pitch of the note heard depends on the speed of the movements transmitted by the impacts to the air, which in the case of any given string is assumed to be constant throughout. Compare the passages of Heraclides at 30.1–31.21, [Aristotle] *De audib.* at 75.14–27, [Eucl.] *Sect. can.* at 90.7–23.

¹³¹ With the phrase *en tois topikōterois* (translated here as 'in my more popular writings') cf. the expression *topikōteroi logoi* at Hermog. *Peri ideōn logou* 2.11.181. In that passage it seems to refer to arguments based on plausibility rather than truth, such as those discussed in Aristotle's *Topics*. Aelianus is perhaps referring to speeches or essays composed in the manner of a sophist rather than a philosopher (cf. n. 125 above). But it is possible that the phrase means merely 'in more appropriate places'.

¹³² All Greek writers agree that when the combination of two notes produces a concord (*sympḥōnia*) they blend together completely; neither note stands out from the mixture and is heard individually. Hence if either predominates the result is not a concord. Aelianus will make this point shortly, at 35.26–36.3; cf. e.g. Xenocrates quoted at 30.7 above, Theophrastus at 63.15–28 below.

¹³³ Aelianus apparently means that this is why the word *diastēma*, rather than *sympḥōnia*, is used for the general case which includes both concords and discords.

¹³⁴ The syntax of the passage from 35.17 to this point is confusing, but neither that nor its sense is as impenetrable as Alexanderson ad loc. suggests. The 'because' (*epei*) at the beginning is picked up in the 'for this reason' (*dioper*) at 35.20, and what follows is the sentence's main clause. What lies behind Aelianus' remarks, I think, is the fact that the word 'concord' (*sympḥōnia*) means literally merely a 'sounding-together', but in fact it has a more specialised sense, and not every pair of differently pitched notes, when sounded at the same time, is properly called a *sympḥōnia*. Some intervals are *sympḥōniai* and some are not; and we therefore use the neutral term *diastēma* when we are referring to intervals in general.

- τὸ αὐτὸ πτῶσις καὶ κρᾶσις. δεῖ γὰρ τοὺς φθόγγους συγκρουσθέντας ἔν τι ἕτερον εἶδος φθόγγου ἀποτελεῖν παρ' ἐκείνους, ἐξ ὧν φθόγγων ἡ συμφωνία γέγονεν. ὥσπερ γὰρ εἴ τις βούλοιτο οἰνόμελι ποιῆσαι ποσόν
- (30) τι μέλιτος λαβὼν καὶ ποσόν οἴνου, ὅταν οὕτω κερᾷσῃ, ὥστε μὴ ἐπικρατεῖν τὸν οἶνον μήτε τὸ μέλι, ἀλλὰ τινι συμμετρίᾳ κραθῇ, τρίτον τι γίνεται κρᾶμα, ὃ μήτε οἶνος μήτε μέλι ἐστίν· οὕτως ὅταν ὀξύς καὶ βαρὺς φθόγγος κρουσθέντες ἔν τι τῇ ἀκοῇ παρασχῶσι κρᾶμα μὴ δ' ἑτέρου τῶν φθόγγων τὴν ἰδίαν παρεμφαίνοντος δύναμιν, ἀλλὰ τρίτον ἐξηχῇ τῇ ἀκοῇ
- (36) παρὰ τὸν βαρὺν καὶ τὸν ὀξὺν φθόγγον, τότε καλεῖται σύμφωνον. ἐὰν δ' ἡ ἀκοὴ τοῦ βαρέος μᾶλλον ἀντίληψιν ποιῇται ἢ πάλιν τοῦ ὀξεος, ἀσύμφωνόν ἐστι τὸ τοιοῦτο διάστημα.” ταῦτα μὲν οὖν παρ' Αἰλιανοῦ.
- Ἐπεὶ δὲ τὰς συμφωνίας ἐν λόγοις ἀριθμητικοῖς ἐτίθεντο οἱ Πυθαγόρειοι, οἷον ἐπιτρίτοις ἢ ἡμιολίοις ἢ διπλασίοις καὶ ἄλλοις τοιοῦτοις, ὡς ἐν τῷ περὶ τῶν συμφωνιῶν ἀκριβώσομεν λόγῳ, ἐξηγούμενος, πῶς ἂν μετρηθῇ ἡ κίνησις ἡ ποιοῦσα τὸν ὀξὺν ἢ τὸν βαρὺν φθόγγον, γράφει οὕτως·
- “Ἐπεὶ δ' ἀπεδείξαμεν, ὅτι ἡ ταχεῖα κίνησις ὀξὺν ἀποτελεῖ φθόγγον, ἡ
- (10) δὲ βραδεῖα βαρὺν, συμφανές, ὅτι ἡ κίνησις ἢ τὸ τάχος τῆς κινήσεως, <ἀφ' ἧς> ὁ ὀξύς φθόγγος γίνεται, πρὸς τὴν κίνησιν ἢ τὸ τάχος τῆς κινήσεως, ἀφ' ἧς ὁ βαρὺς γίνεται φθόγγος ἐν ἐπιτρίτῳ ἐστὶ λόγῳ. χάριν μέντοι τοῦ μηδὲν παραλελειφθαι καὶ τοῦτο σαφηνείας τεύζεται, πῶς λέγεται τάχος κινήσεως πρὸς ἑτέρου τάχος ἐπίτρίτον εἶναι ἢ διπλάσιον ἢ
- (15) οἷον δήποτε λόγον ἔχειν. εἰ γὰρ δύο εἴη τὰ κινούμενα ἀνίσως καὶ τὸ ἕτερον αὐτῶν ἐν ταύτῳ χρόνῳ τοῦ ἑτέρου διπλάσιον τάχει χρᾶτο, ἔσται τὸ ὑπὸ τοῦ θάττον κινουμένου διπλάσιον ἡνυσμένον διάστημα τοῦ ἑτέρου, ὥστε τὸ μὲν εἶναι φέρε εἰπεῖν ἡνυσμένον διάστημα ὑπὸ τοῦ τάχιον κινουμένου πηχῶν δέκα, τὸ δ' ἕτερον πηχῶν πέντε, οὕτω λέγεται διπλάσιον
- (20) τάχει κεκρῆσθαι. καὶ ἄλλως δὲ νοεῖν πάρεστι τὸ ἐξηγητικὸν τῆς τῶν ταχῶν συγκρίσεως. φέρε γὰρ τὸ αὐτὸ διάστημα, οἷον δεκαστάδιον, ὑπὸ μὲν τοῦ τάχιον κινουμένου ἐν ὥραις δυσὶ διηνῆσθαι, ὑπὸ δὲ τοῦ βράδιον ἐν ὥραις τετράσιν, ὃν λόγον ἔχει ὁ χρόνος, ἐν ᾧ τὸ βραδέως κινούμενον

31 τι om. g 32 ὅταν] ἂν T

5 ἡ — ἄλλοις om. Mg 9 ὀξὺν — 10 κίνησις om. T 11 <ἀφ' ἧς> add. Wallis
12 ἐπιτρίτῳ] τινι conl. Alexanderson 21 συγκρίσεως] κινήσεως g 22 διηνῆσθαι T δεικνυσθαι
ceteri

that differ in height and depth. For when the notes are played together they must produce another, unified sort of note,¹³⁵ beside those notes from which the concordance arose. For just as when someone wants to make oenomei – taking so much | honey and so much wine, mixing them in such a way that neither the wine nor the honey predominates but they are blended in a certain proportion – a third thing is produced, a blend which is neither wine nor honey, just so when a high and a low note have been played and present to the hearing a blend in which neither of the notes reveals its own individual character, but a third thing resounds to the hearing beside the low and the high notes, then it is called concordant. But if the hearing receives the low or the high note more strongly, this sort of interval is non-concordant.

[36D]

That is what Aelianus says. And since the Pythagoreans represented the concords in | numerical ratios, epitritics, hemiolic, doubles and others of that sort (as we shall explain in precise detail in our account of the concords, when Ptolemy is expounding the way in which the movement that makes a high or a low note can be measured), he writes as follows.

Since we have demonstrated that a swift movement produces a high note and a | slow movement a low one, it is clear that the movement or the speed of the movement from which the high note arises is in epitritic ratio with the movement or the speed of the movement from which the low note arises.¹³⁶ But to ensure that nothing has been passed over, we shall also clarify what is meant by saying that the speed of a movement is in epitritic or double ratio or | in any ratio whatever to the speed of another. For if two things are travelling at unequal rates, and one of them travels at double the speed of the other in the same period of time, the distance (*diastēma*) traversed by the one travelling more swiftly will be double the distance of the other, so that the distance travelled by the one moving more swiftly will be for instance ten feet and the other distance will be five feet. That is what is meant by having double | the speed.

One can understand how the comparison of speeds can be explicated in another way too. Suppose that the same distance, say ten stades, is traversed in two hours by the thing moving more swiftly, and in four hours by the one moving more slowly. Then the ratio between the speed of movement of the one moving more swiftly and the speed of movement of the one moving

¹³⁵ The word 'note' (*phthonggos*) is rarely used elsewhere of the sound constituted by the combination of the two notes of a concord, and the usage is potentially misleading; the combination is not another note, distinct from the original two. Perhaps this is why Aelianus does not call it simply a note, but a 'sort' or 'form' (*eidos*) of note.

¹³⁶ If the text is correct, Aelianus must be thinking of notes separated by the interval of a perfect fourth (these being in epitritic ratio, 4:3), which he had perhaps been discussing in the passage immediately before the quotation begins. But Alexanderson may be right in thinking that the text originally had some vague term such as *timi* ('some') where the MSS read *epitritōi* ('epitritic'), and that the latter word has crept in from a marginal note, added by way of example.

- διήνυσσε τὰ δέκα στάδια, πρὸς τὸν χρόνον, ἐν ᾧ τὸ ταχέως κινούμενον
- (25) διήνυσσε τὸ αὐτὸ διάστημα, τουτέστιν αἱ τέσσαρες ὥραι πρὸς τὰς δύο, τοῦτον ἔξει τὸν λόγον ὑπεναντίως τὸ τάχος τῆς κινήσεως τοῦ θάττον κινουμένου πρὸς τὸ τάχος τῆς κινήσεως τοῦ βραδέως κινουμένου. ἐπεὶ δ' οἱ τε χρόνοι τῆς τῶν συνεχῶν φύσεώς εἰσιν, καὶ τὰ διανυόμενα ὑπὸ τῶν κινουμένων διαστήματα—τουτέστι τὰ μεγέθη—καὶ ταῦτα τῶν
- (30) συνεχῶν, ἔστι δῆλον, ὅτι οἱ τε χρόνοι ἀλλήλοις συγκρινόμενοι ὁμογενεῖς εἰσι καὶ τὰ ἡνυσμένα διαστήματα ὁμογενῆ, οἷον εὐθεῖαι τε πρὸς εὐθείας καὶ κύκλων περιφέρειαι πρὸς περιφέρειας. εἰς ἄπειρον δ' οὕσης τῆς τομῆς τῶν συνεχῶν ἃ μὲν εἰσι σύμμετρα, ἃ δ' ἀσύμμετρα καὶ τὰ μὲν
- (37) σύμμετρα διὰ λόγου ἀριθμῶν θεωρεῖται, τὰ δ' ἀσύμμετρα οὐκ ἔστιν ἐν λόγοις ἀριθμῶν. τὸ δ' αὐτὸ καὶ ἐπὶ τῶν ταχῶν χρῆ νοεῖν καὶ ὅτι καὶ ἐν τούτοις τὰ μὲν ἔστι σύμμετρα, τὰ δ' οὐ. καὶ ὅπου μὲν ἡ τῶν ταχῶν σύγκρισις ἐν συμμετρίας θεωρεῖται, λόγον ἔχει τὰ τάχη πρὸς ἄλληλα, ὃν
- (5) ἀριθμὸς πρὸς ἀριθμόν.”

- Τούτων ἡμῖν διηρθρωμένων φανερά γέγονεν ἡ τῶν Πυθαγορείων αἵρεσις καὶ ὅτι τὰς διαφορὰς τῶν ψόφων τὰς κατ' ὀξύτητα καὶ βαρύτητα ἐν ποσότητι ἐτίθεσαν, οἷς ὁ Πτολεμαῖος ἠκολούθησεν. διὰ δὲ ταύτην τὴν αἰτίαν τὰ ποιητικὰ μέλους καὶ ρυθμοῦ οὐχ ἕτερα, καθάπερ ἄλλοι, τὰ δ'
- (10) αὐτὰ ἀναγκαῖον ἦν αὐτοῖς παραδέχεσθαι, ἔτι δ' ἀμφοῖν τῆς ὑποστάσεως ταχυτῆς καὶ βραδυτῆς αἰτία. διὸ ὥσπερ τοῖς ἀριθμοῖς τοὺς λόγους τῶν συμμετριῶν προσάπτομεν ἐν ἴσῳ λόγῳ καὶ διπλασίονι καὶ ἡμιολίῳ τιθέντες τινάς, οὕτωςι δὲ καὶ ταῖς συμφωνίαις οἱ Πυθαγόρειοι τοὺς ἀριθμητικούς λόγους προσῆπτον.

- (15) Μαρτυρεῖ δὲ τῷ λόγῳ καὶ Διονύσιος ὁ μουσικὸς ἐν τῷ πρώτῳ Περὶ ὁμοιοτήτων λέγων ταῦτα.

- “Κατὰ μὲν γε τοὺς κανονικοὺς μία σχεδὸν καὶ ἡ αὐτὴ οὐσία ἐστὶ ρυθμοῦ τε καὶ μέλους, οἷς τό τε ὀξύ ταχύ δοκεῖ καὶ τὸ βαρὺ βραδύ. καὶ καθόλου δὲ τὸ ἡρμωσμένον κινήσεων τινων συμμετρία καὶ ἐν λόγοις ἀριθμῶν τὰ ἐμμελῆ διαστήματα.
- (20) ὥστ' εἴπερ ἀληθῆ τὰ ὑπὸ τούτων λεγόμενα—δοκεῖ δὲ πολλοῖς καὶ εὐδοκίμοις ἀνδράσιν — εἰσὶ δὲ καὶ οἱ ρυθμοὶ πάντες ἐν λόγοις τισὶν

24 τὰ — 25 διήνυσσε om. T 28 οἱ τε om. g 29 διαστήματα Wifstrand διαστημάτων codd. ταῦτα Wifstrand τὰ αὐτά codd. 32 κύκλων] κύκλω MG 33 ἃ μὲν εἰσι σύμμετρα om. T

8 ποσότησιν Mg 11 ἀριθμοῖς] ἀριθμητικοῖς g 15 τῷ λόγῳ om. G

more slowly will be the inverse of the ratio between the time in which the one moving slowly traversed the ten stades and the time in which the one moving swiftly | traversed the same distance, that is, the ratio of four hours to two. Now since durations of time have the nature of continuous things, and since the distances traversed by the things in motion, that is, the magnitudes, also belong to the class of | continuous things, it is clear both that the times compared with one another are things of the same kind, and that the distances traversed are of the same kind too, just as are straight lines in relation to straight lines and circumferences in relation to circumferences. And since the division of continuous things can proceed to infinity, some <segments> are commensurable and others incommensurable; the commensurable are grasped through a ratio of numbers, while the incommensurable are not in ratios of numbers. It must be understood that the same holds also of speeds, and that in their case too, some are commensurable and some are not. Where the relation between speeds is grasped as commensurable, the speeds stand to one another in the ratio of | a number to a number.

[37D]

Now that we have explored these matters it has become clear also that the Pythagorean school located the differences between sounds in respect of high and low pitch in <the category of> quantity, and Ptolemy followed them. For this reason it was necessary for them to accept that the things which produce melody and rhythm are not different, as other people think, | but the same, and that swiftness and slowness are the cause of the constitution of both of them. Thus just as we attach to the numbers <involved in rhythms> the ratios of their relative measurements,¹³⁷ putting instances of them in equal, double and hemiolic ratio, so the Pythagoreans attached numerical ratios also to the concords.

| Dionysius the music-theorist¹³⁸ bears witness to what we have said in the first book of his *On Similarities*. These are his words: 'According to the *kanonikoi* who think that what is high pitched is swift and what is low pitched is slow, rhythm and melody have virtually one and the same essence (*ousia*). And in general, attunement is the commensurateness of certain movements, and | the melodic intervals are in ratios of numbers. Thus if what these people say is true (and it is the opinion of many distinguished men), and if all rhythms too are in certain ratios of numbers,

¹³⁷ 'Relative measurements' translates *summetriōn*, the same noun as is used above to mean 'commensurability'.

¹³⁸ This must be Aelius Dionysius (second century AD), best known as a lexicographer, but also (according to the *Suda* s.v. Διονύσιος) the author of a history of music, a study of rhythemics, a work on musical education and an essay on Plato's discussions of music in the *Republic*.

ἀριθμῶν, οἱ μὲν διπλασίοις, οἱ δ' ἴσοις, οἱ δ' ἄλλοις τισὶ, τῆς αὐτῆς φύσεως δόξειεν ἂν εἶναι μέλος καὶ ῥυθμός.”

- (25) Καὶ πάλιν δόξουσι δὲ καὶ οἱ κανονικοὶ συνεπιμαρτυρεῖν τὸ αὐτὸ τοῦτο, λέγω δὲ τὰς συμφωνίας καὶ τοὺς ποδικοὺς λόγους ἔχειν τὸ συγγενὲς καὶ οἰκεῖον. τὰς τε γὰρ συμφωνίας ὑπὸ τῶν λόγων τούτων γίνεσθαι νομίζουσι, τὴν μὲν διὰ τεσσάρων ὑπὸ τοῦ ἐπιτρίτου, τὴν δὲ διὰ πέντε ὑπὸ τοῦ ἡμιολίου, <τὴν δὲ διὰ πασῶν ὑπὸ τοῦ διπλασίου,> τὴν δὲ διὰ πασῶν καὶ
- (30) διὰ πέντε ὑπὸ τοῦ τριπλασίου· ὁ μὲν γ' ἴσος λόγος τοῦ ὁμοφώνου παρασκευαστικός ἐστιν αὐτοῖς, καὶ οἱ ῥυθμητικοὶ πόδες κατὰ τοὺς αὐτοὺς τούτους λόγους διακεκριμένοι τυγχάνουσι κατὰ μὲν τὸν ἴσον καὶ δι-
- (38) πλάσιον καὶ ἡμιόλιον οἱ πλεῖστοι καὶ εὐφυέστατοι, ὀλίγοι δὲ τινες καὶ κατὰ τὸν ἐπίτритον καὶ κατὰ τὸν τριπλάσιον.
- Ἄ μὲν οὖν ἐχρῆν προειπεῖν τοῦ προκειμένου σκέμματος μετὰ παραλήψεως τῶν πρὸ ἡμῶν ἐλλογίμων ἀνδρῶν, ἔστι ταῦτα. λοιπὸν δὲ τὴν
- (5) λέξιν τοῦ Πτολεμαίου διαρθρωτέον, ἥς ἀναπτυσσομένης καὶ ἡ Πλάτωνος περὶ τούτων δόξα καὶ ἡ τοῦ Ἀριστοτέλους ὑποδειχθήσεται, παρ' ὧν τὰ πλεῖστα ὁ ἀνὴρ ὠφελημένος καταφαίνεται.

Τῆς τοίνυν ἐν τοῖς ψόφοις διαφορᾶς κατὰ τε τὸ ποιὸν καὶ κατὰ τὸ ποσὸν ὥσπερ καὶ ἐν τοῖς ἄλλοις πᾶσι συνισταμένης τὴν περὶ τὰς ὀξύτη- [15] τας καὶ βαρύτητας ἐν ὁποτέρῳ γένει τῶν εἰρημένων θετέον, οὐκ ἔστιν ἀποφήνασθαι προχείρως, πρὶν ἐπισκέψασθαι τὰ αἵτια τοῦ τοιοῦτου συμπτώματος, ἃ μοι δοκεῖ κοινὰ πως εἶναι καὶ τῶν ἐν ταῖς ἄλλαις πληγαῖς παραλλαγῶν.

- (10) Ἡ βαρύτης καὶ ἡ ὀξύτης ἡ τῶν ψόφων διαφορὰ καὶ συμβεβηκότα τῶν ψόφων εἰσίν. αὐτὸς γὰρ καθ' ἑαυτὸν ἐπινοούμενος ὁ ψόφος οὐ συνεπιβάλλει μεθ' ἑαυτοῦ τὸ ὀξύ ἢ τὸ βαρὺ, ὥς οὐδὲ τὸ σῶμα τὸ χρῶμα, εἰ καὶ

29 <τὴν – διπλασίου> add. Wallis

32 διακεκρυμμένοι g τόν] τό g

4 ἐλλογίμων Mg 7 ὁ om. m
om. g κατὰ συμβεβηκός Alexanderson

8 Ἀρχὴ τοῦ τρίτου κεφαλαίου add. p 9 καὶ συμβεβηκότα
10 συνεπιβάλλει Düring συνυποβάλλει codd.

in lemmate: 6.14 κατὰ^{sec.} om. Mp

15 ἀπασι MEp

some in double ratio, some in equal and some in others, melody and rhythm would seem to have the same nature.¹³⁹

| Once again it will be clear that the *kanonikoi* too join in bearing witness to the same thesis, I mean that the concords and the ratios of the rhythmic feet are closely akin. For they believe both that the concords arise through these ratios (the fourth through the epitritie [4:3], the fifth through the hemiolic [3:2], <the octave through the double [2:1],> and the octave and | a fifth through the triple [3:1], while for them the equal ratio [1:1] produces the unison), and also that the rhythmic feet are distinguished according to the same ratios, the majority and the most elegant of them according to the equal, the double and the hemiolic, but also a few according to the epitritie and the triple.¹⁴⁰

[38D]

That, then, is what needed to be said by way of introduction to the enquiry in front of us, recruiting in support the work of our eminent predecessors. It remains for us to explicate the statements of Ptolemy, in unravelling which we shall also set out Plato's | opinion on these matters, and Aristotle's too, since Ptolemy has evidently benefited greatly from their works.

Among sounds, as among all other things, there are differences in respect of both quality and quantity, and to which of the two specified classes the difference related to heights and depths of pitch¹⁴¹ belongs is not something that can be shown off-hand, before the causes of this kind of attribute have been investigated, causes which seem to me to be shared in some way with variations in other sorts of impact. Ptol. *Harm.* 6.14–19

Depth and height of sounds are differences and accidental attributes | of sounds. For considered simply in itself sound does not bring with it high pitch or low, just as body does not bring a colour, even though body is

¹³⁹ Düring treats only the first two sentences of this passage (37.17–20) as quoted from Dionysius, but I think it likely that the quotation continues through the third (37.21–4). He also extends the parenthesis in the last sentence as far as 'some in others', and does not include the thesis about rhythms in the protasis of the conditional; but it is needed as a premise for the inference the author draws.

¹⁴⁰ Cf. e.g. Arist. Quint. I.14, especially the statement at 33.29–30. The more restrictive view of the rhythmic ratios, admitting only 1:1, 2:1 and 3:2, is adopted by Aristoxenus (*El. rhythm.* II p. 24 Pighi); a more generous view, including also the epitritie ratio 4:3, is attributed to people who combine rhythmic with metrics at Arist. Quint. I.18, 38.15–20.

¹⁴¹ In parts of the remainder of this long chapter it is important to remember the literal meanings of the Greek words representing levels of pitch, since their metaphorical applications to sounds sometimes leave their stamp on the acoustic theories. What we call 'high' is *oxyis*, 'sharp', and what we call 'deep' or 'low' is *barys*, 'heavy'. They are also sometimes characterised in terms of 'increasing and decreasing tension', *epitasis* and *anesis*, where greater tension is associated with higher pitch.

- πάντως τὸ σῶμα μετὰ τοῦ χρώματος. ἐν τίνι οὖν γένει θετέον τὴν ὀξύτητα καὶ τὴν βαρύτητα; ἄρα γ' ἐν τῷ ποιῶ ἢ ἐν τῷ ποσῶ; τοῦτο δέ φησιν οὐκ εἶναι ῥάδιον ἀποφύνασθαι, πρὶν ἐπισκέψασθαι τὰ αἷτια τῆς
- (15) ὀξύτητος καὶ βαρύτητος, ἃ κοινὰ πῶς ἐστί καὶ τῶν ἐν ταῖς ἄλλαις πληγαῖς παραλλαγῶν. ἐπεὶ γὰρ ὁ ψόφος τῷ γένει πληγῇ, ψόφου δὲ διαφορὰ ἡ ὀξύτης καὶ ἡ βαρύτης ἢ ἐν τοῖς ἤχοις, κοινῶς φησι δεῖ ἐπισκέψασθαι τὰς τῶν πληγῶν διαφοράς, ἐν αἷς καὶ ἡ κατὰ τοὺς ψόφους διαφορὰ περιληφθήσεται. ὅτι δὲ καὶ κατ' αὐτὸ τὸ ποιὸν προφανῶς διαφέρουσι ψόφοι, αὐτὸς προῖων ἐπιδείξει λείους καὶ τραχεῖς ψόφους καὶ τινὰς ἄλλους παρατιθεῖς, ὧν ἡ διαφορὰ αὐτόθι κατὰ ποιότητα εἶναι συγκεχώρηται.
- (20)

γίνεται γὰρ τὰ ἐξ αὐτῶν πάθη διαφέροντα παρὰ

τε τὴν τοῦ πλήττοντος βίαν καὶ παρὰ τὰς σωματικὰς συστάσεις τοῦ τε [20] πληττομένου καὶ τοῦ δι' οὗ ἡ πληγῇ, καὶ ἔτι παρὰ τὴν ἀποχὴν τοῦ πληττομένου πρὸς τὴν ἀρχὴν τῆς κινήσεως. σαφῶς γὰρ τῶν ἄλλων ὑποκειμένων τῶν αὐτῶν ἕκαστον τῶν εἰρημένων ἰδιὸν τι ποιεῖ περὶ τὸ πάθος, ὅταν αὐτὸ διενέγκῃ καθ' ὄντινα οὖν τρόπον.

- (23) Τὰ ἐκ τῶν πληγῶν πάθη κοινῶς σκοπούμενοι διαφέροντα γίνεται διὰ τρία ταῦτα· ἢ γὰρ παρὰ τὴν τοῦ πλήττοντος βίαν διάφορος ἡ πληγῇ
- (25) γίνεται καὶ τὸ τῆς πληγῆς πάθος—ἄλλως γὰρ ὁ ἀσθενὴς πλήττει, ἄλλως ὁ ἰσχυρὸς—ἢ παρὰ τὰς σωματικὰς συστάσεις τοῦ πληττομένου καὶ τοῦ δι' οὗ ἡ πληγῇ. πλήττοντα δὲ καὶ πληττόμενα οὐ μόνον τὰ στερεὰ θετέον εἶναι, οὐδὲ τὸ ὕδωρ φέρε καὶ τὸ πῦρ μόνον, ἀλλὰ καὶ τὸν ἀέρα· τῶν γὰρ πληττομένων καὶ πληττόντων καὶ οὗτος· καὶ οὐ πάντως γε τῶν
- (39) πληττομένων ἐν ταῖς εἰς ἄλληλα συγκρούσεσι τῶν σωμάτων. πλήττει δ' ὅταν ῥύσιν λαβὼν πνεῦμα γένηται σφοδρόν, ὥσπερ οἱ ἄνεμοι. δευτέρα οὖν ἔστω διαφορὰ ἡ περὶ τὰς σωματικὰς συστάσεις τοῦ πληττομένου καὶ τοῦ δι' οὗ ἡ πληγῇ. ἄλλως γὰρ φέρε σπογγιὰ σπογγιὰν πλήσσει ἢ
- (5) ἔριον, ἄλλως χαλκὸς λίθον ἢ σίδηρον. ἐκ τρίτων δὲ διάφοροι γίνονται αἱ πληγαὶ καὶ παρὰ τὴν ἀποχὴν τοῦ πληττομένου καὶ τοῦ αἰτίου τῆς πληγῆς. ἄλλως γὰρ ἐπὶ πλείστον ἀπεχόντων ἀλλήλων διάστημα τοῦ τε πλήττοντος καὶ τοῦ πληττομένου γίνεται ἡ πληγῇ, ἄλλως δ' ἐπ' ἑλαττον.

18 τῶν om. p παραληφθήσεται T

2 πνεύματα G

invariably accompanied by colour. In which class, then, should height and depth be placed? Is it in that of quality or that of quantity? This, Ptolemy says, is not easy to elucidate until one has investigated the causes of | height and depth, causes which are somehow shared by the differences between other impacts. For since a sound is, generically, an impact, and since height and depth of the sort that occur in sounds [*ēchoi*] are differences between sounds, one must investigate, he says, the differences shared by impacts in general, among which the differences related to sounds will be included. He himself will show, as he goes on, that sounds evidently differ also in respect of quality, | giving as examples smooth and rough sounds and various others, the difference between which is immediately agreed to be a difference in respect of quality.

For the attributes [*pathē*] arising from them become different in accordance with the force of the striker, and with the bodily constitutions both of the thing struck and of the thing with which the impact is made, and again in accordance with the distance of the thing struck from the origin of the movement. For it is clear that if the other factors involved remain the same, when each of the things mentioned differs in one way or another it has its own special effect on the resulting attribute. Ptol. *Harm.* 6.19–24

When considering the attributes [*pathē*] arising from impacts in general, we see that they differ on account of these three causes. The impact and its attribute become different either in correspondence with | the force of the striker – for a weak man strikes in one way and a strong man in another – or in correspondence with the bodily constitutions of the thing that is struck and of the thing by means of which the impact is made. And one should not posit that only solids are strikers and things struck, nor that they are only water and fire, for instance, but one should include air as well, since it too is one of the things that are struck and strike; and it is not always <merely> one of the things struck when bodies clash against one another. For it strikes whenever the flow of breath becomes vigorous, just as winds do. So let the second difference be that related to the bodily constitutions of that which is struck and that by means of which the impact is made. For a sponge strikes a sponge or | a piece of wool, for instance, in a different way from that in which bronze strikes stone or iron. The impacts become different, thirdly, in correspondence with the distance between the thing struck and the cause of the impact. For the impact occurs in one way when the striker and the thing struck are separated by a very great distance, and in another when the distance is less.

[39D]

- (10) Ἐπεὶ γὰρ “ἀδύνατον”, ὥς φησι καὶ Ἀριστοτέλης, “ἐνὸς ὄντος πληγὴν γενέσθαι”—“πρὸς τι” γὰρ ἡ πληγὴ καὶ ἀπὸ τίνος, “ἐν τινί”, δεῖ δὲ καὶ διὰ τίνος—ἀνάγκη καὶ παρὰ τὴν βίαν τοῦ τύπτοντος διάφορον τὴν πληγὴν γίνεσθαι καὶ παρὰ τὰς σωματικὰς συστάσεις τοῦ πληττομένου καὶ τοῦ δι’ οὗ ἡ πληγὴ, καὶ ἔτι παρὰ τὴν διάστασιν καὶ ὅλως τὸ πόρ-
 (15) ρωθεν ἢ ἐγγύθεν εἶναι τὸ πληττόμενον τοῦ τῆς κινήσεως κατάρχοντος. σαφῶς γὰρ τῶν ἄλλων τῶν αὐτῶν ὑποκειμένων ἕκαστον τῶν εἰρημένων ἴδιόν τι ποιεῖται, παρ’ ὃ τὸ διάφορον ἀπεργάζεται πάθος. διάφορον δ’ ἀπεργάζεται πάθος, ὅταν αὐτὸ διάφορον ἢ καὶ παρηλλαγμένον καθ’ ἓνα τῶν εἰρημένων τρόπων. τὸ γὰρ “ὅταν αὐτὸ διενέγκῃ” ἀκουστέον ἀντὶ τοῦ
 (20) “ὅταν αὐτὸ διαλλάττον καὶ διάφορον γένηται”. διενεγκεῖν γὰρ λέγομεν τὴν ἀρετὴν τῆς κακίας, ὅτι ἡ μὲν ὠφελεῖ, ἡ δὲ βλάπτει. καὶ διήνεγκεν ἦδε ἡ πρᾶξις τῆσδε τῆς πράξεως, τὸ διενεγκεῖν ἐπὶ πάντων τούτων ἀντὶ τοῦ διαφέρειν καὶ ἐξηλλάχθαι παραλαμβάνοντες.

τῶν δὲ ψόφων ἡ

**μὲν παρὰ τὴν σύστασιν τοῦ πληττομένου διαφορά ἢ οὐδόλως ἂν γίνοιτο [25]
 ἢ οὐκ αἰσθητὴ γε διὰ τὸ καὶ τὴν τῶν ἀέρων παραλλαγὴν οὕτως ἔχειν
 πρὸς τὴν αἴσθησιν**

- (25) Τὰς κοινὰς αἰτίαις τῆς διαφορᾶς τῶν πληγῶν καταριθμησάμενος ἔπεισι καθ’ ἑκάστην ἐπὶ τῶν ψόφων—πληγαὶ γὰρ καὶ οὗτοι—δεικνύς, τίνων παθῶν ἐν αὐτοῖς εἰσι ποιητικαὶ καὶ πῶς ἀλλήλων διαφερόντων. εἴπ’ ἐπειδὴ πληγὴ ἦν ἀέρος ὁ ψόφος, εἰσὶ δ’ ἀέρων πολλὰ κατὰ σύστασιν διαφοραί, εἴ γε οἱ μὲν θερμοί, οἱ δὲ ψυχροὶ καὶ οἱ μὲν ὀμιχλώδεις, οἱ δὲ
 (30) καθαροί, καὶ ἄλλαι πολλὰ διαφοραὶ ἀέρων λανθάνουσαι τὴν αἴσθησιν, τὰς μὲν τούτων διαφορὰς μηδεμίαν ψόφων ἀποτελεῖν παραλλαγὴν, οὗτι γε αἰσθητὴν τίθεται, ὥστε τῶν παρὰ τὰς σωματικὰς συστάσεις τοῦ πληττομένου διαφορῶν αἱ τοῦ πλησσομένου ἀέρος διαφοραὶ αἱ καθ’ ὅσον ἀήρ

11 πληγὴν] ψόφον Ar. γίνεσθαι g cod. Ar. Ambros. H50

12 ἀνάγκης g

32 τίθεσθαι T

| Since, as Aristotle also says,¹⁴² 'it is impossible for an impact to occur when there is only one thing' – for the impact is 'against something' and from something, 'in something', and must also be by means of something – the impact necessarily becomes different in correspondence with the force of the striker, with the bodily constitutions of that which is struck and that by means of which the impact is made, and also with the distance, that is, to put it generally, with whether the thing struck is | further from or nearer to that which initiates the movement. For clearly if the other factors remain the same, each of the things mentioned does something distinctively its own, in correspondence with which a different attribute is produced. A different attribute is produced whenever it [the causal factor] itself is different and is altered in one of the ways that have been mentioned. For the phrase 'whenever it differs' is to be understood as standing in place of | 'whenever it changes and becomes different'. For we say that virtue 'differs' from vice, because the former benefits and the latter harms; and this action 'differs' from that. In all these cases we use 'to differ' in place of 'to be different' and 'to have been altered'.¹⁴³

In the case of sounds, the difference related to the constitution of the thing struck either does not occur at all, or is not perceptible, since a difference between specimens of air¹⁴⁴ is also imperceptible to the senses. Ptol. *Harm.* 6.24–7

| Now that he has enumerated the causes common to the differences between impacts, he goes on to address them one by one as they apply to sounds, since these too are impacts, showing which attributes of sounds they are capable of causing and how these attributes differ from one another. Then since a sound is an impact on the air,¹⁴⁵ and there are many differences in constitution between instances of air – given that some are hot, some cold, some murky and some | pure, and that there are many other differences between specimens of air that elude perception – he lays it down that the differences between them produce no alteration in sounds, or at any rate none that is perceptible; so that among the differences in the bodily constitutions of that which is struck, the differences in the air which is

¹⁴² *De anima* 419b11.

¹⁴³ Porphyry's laboured explanation is as strange in Greek as in English, since the verb he is trying to explicate, διενέγκη, is merely a part of the (irregular) verb which he uses to explain it, διαφέρειν.

¹⁴⁴ Literally, 'a difference of airs', as also at 39.30 below.

¹⁴⁵ The expression *plēgē aeros*, very common in contexts of this sort, is ambiguous; it can mean either 'an impact of the air' (on something else) or 'an impact on the air' (made by something else); cf. 46.14–29 below. Here, as most often, the sense is certainly the latter.

- (40) οὐδέν πρὸς τὴν τῶν ψόφων ὀξύτητα ἢ βαρύτητα συντελοῦσιν, αἱ δὲ τῶν ἄλλων σωμάτων διάφοροι συστάσεις ποιοῦσι παραλλαγάς, ὡς ὕστερον ἐπιδείξει. ἦν δ' ἐν ταῖς τῶν ἄλλων σωμάτων πληγαῖς καὶ ὁ ἄηρ πληττόμενος καὶ σχεδὸν πάσαις ταῖς αἰσθήσεσι συνεργὸς πρὸς τὰ ἐκ τῶν
- (5) αἰσθητῶν πρὸς αὐτάς ἰόντα πάθη, ἀλλ' αἱ μὲν αὐτοῦ κατὰ σύστασιν διαφοραὶ οὐδεμίαν παραλλαγὴν εἰς ὀξύτητα καὶ βαρύτητα ἐμποιοῦσι τοῖς ψόφοις, αἱ δὲ τῶν ἄλλων ἅς ποιοῦσι διαφορὰς μετ' ὀλίγον διέξεισιν.

ἡ δὲ παρὰ τὴν τοῦ πλήττοντος βίαν μεγέθους ἄν

[7] εἶη μόνον αἰτία καὶ οὐκ ὀξύτητος ἢ βαρύτητος. ἐπὶ γὰρ τῶν αὐτῶν οὐδεμίαν ὁρῶμεν τοιαύτην ἀλλοίωσιν περὶ τοὺς ψόφους ἐπιγινομένην, ἡσυχαιότερον φέρε εἰπεῖν φθεγγομένων ἢ γεγωνότερον καὶ πάλιν ἡρεμαιοότερον ἐμπνεόντων καὶ κρουόντων ἢ σφοδρότερον ἢ ἁδρότερον, ἀλλὰ μόνον τῷ μὲν βιαιοτέρῳ τὸ μείζον ἐπόμενον, τῷ δὲ ἀσθενεστέρῳ τὸ ἔλαττον. [5]

- (10) Ἡ βία φησὶν ἡ τοῦ πλήττοντος ἢ ἡ ἀσθένεια μέγεθος μὲν ἢ μικρότητα τοῖς ψόφοις περιποιεῖν δύναται, κατ' ὀξύτητα δ' ἢ βαρύτητα διαφορὰν οὐκέτι. ἔστι γὰρ τὸν ὀξὺν ψόφον ἡρέμα μὲν προφέροντα καὶ ἄνευ βίας μικρὸν ἀποδιδόναι, σφοδρῶς δὲ σὺν βίᾳ μείζονα ποιεῖν. οὐ μὴν ἢ κατὰ μέγεθος ἢ μείωσιν παραλλαγὴ ὀξύτητος ἦν καὶ βαρύτητος διαφορά. καὶ τοῦτο δείκνυσιν ἐπιῶν τὰ τε ἐμπνευστά, τὰ τε ἐντατά καὶ κρουόμενα καὶ
- (15) τὰ ὑπὸ ζῶων φωνούμενα. ἡ γὰρ βία τοῦ φωνοῦντος τὸν αὐτὸν ἤχον τοῦ ψόφου ἢ σφοδρὸν ἢ ἡρεμαῖον ἀπεργάζεται, κατ' ὀξύτητα δ' ἢ βαρύτητα οὐδαμῶς διαφέροντα καὶ μὴν τῶν ἐμπνεόντων ἢ βία καὶ τὸ σφοδρὸν ἢ ἡ ἀσθένεια ὀξὺν μὲν ἢ βαρὺν τὸν ἤχον οὐδαμῶς ἀποτελεῖ, σφοδρὸν δ' ἢ ἀσθενῆ μόνον. ἐπὶ τε τῶν κρουόντων ὁμοίως τῷ μὲν βιαιοτέρῳ ἔπεται
- (20) τὸ μείζον τοῦ ψόφου, τῷ δ' ἀσθενεστέρῳ τὸ ἔλαττον, ὥστε παρὰ μὲν τὴν βίαν ἢ τὴν ἀσθένειαν τοῦ πλήττοντος οὐκ ἂν γένοιτο διαφορὰ κατ' ὀξύτητα τῶν ψόφων ἢ βαρύτητα.

10 βαρύτητα] βραδύτητα T
Alexanderson μείζον codd.

11 ἄνευ βίας Düring ἐὰν ἢ βία codd.
13 παραλλαγὴν M 19 βεβαιωτέρῳ T

12 σὺν] ἐὰν ἢ T μείζονα

struck which affect it *qua* air contribute nothing to the height and depth of the sounds, whereas the different constitutions of the other bodies do make alterations, as he will show later. In impacts between other bodies the air is struck too, and collaborates with virtually all the other | senses too in generating the attributes which come to them from perceptible objects, but the differences in its constitution induce no alteration in the height and depth of the sounds, whereas he will shortly go through the differences which those of the other bodies make. [40D]

But difference related to the force of the striker is the cause only of largeness [i.e. loudness], and not of height or depth. For if other factors are the same, we find no alteration of this sort arising in sounds when, for instance, people make utterances more gently or more loudly, or again when they blow or pluck more mildly or more vigorously or strongly, but only that the greater follows upon the more forceful, the lesser upon the weaker. Ptol. *Harm.* 6.27–7.5

He says that the force or weakness of the striker can produce loudness or quietness¹⁴⁶ | in the sounds, but not a difference in height or depth. For by emitting a high-pitched sound gently and without force it is possible to make it quiet, and by doing so vigorously and with force it is possible to make it louder; and of course a distinction in respect of loudness or diminution is not a difference in height and depth. As he proceeds he demonstrates this by reference to wind instruments, to instruments that are stringed and struck¹⁴⁷ and to | the <organs> used to produce sound by living creatures. For the force of the agent that utters a voice makes the resonance [*ēchos*] of the sound¹⁴⁸ vigorous or gentle, but in no way different in respect of height and depth, and moreover the force of those who blow <into wind instruments> and their vigour or weakness in no way makes the resonance [*ēchos*] high or low, but only vigorous or weak. It is the same with those who strike <the strings of stringed instruments>. Loudness in the sound follows on | from the more forceful, and relative quietness from the weaker, so that in correspondence with the force or weakness of the striker there will arise no difference in the height of the sounds or their depth.

¹⁴⁶ Literally 'largeness or smallness'.

¹⁴⁷ I.e. those whose strings are struck with a plectrum. The verb used here (and usually elsewhere) for 'striking' an instrument, *krouein*, is different from the one used regularly to designate the 'striking' of one thing by another in the production of sound, *plētein*, which is cognate with the noun *plēgē*, translated as 'impact' (another verb, *tuptein*, is occasionally used in its place).

¹⁴⁸ See Introduction pp. 54–5.

ἡ δι' [5]

παρὰ τὰ δι' ὧν αἱ πληγαὶ παραλλαγή λαμβάνεται μὲν ἐνταῦθα παρὰ τὰς πρῶτας τοῦ σώματος συστάσεις, τουτέστι δι' ἃς μανόν ἐστιν ἕκαστον ἢ πυκνὸν καὶ λεπτόν ἢ παχύ, καὶ λεῖον ἢ τραχύ, καὶ ἔτι παρὰ τὰ σχήματα. τί γὰρ ταῖς παθητικωτέrais ποιότησιν, ἀτμοῖς λέγω καὶ χυμοῖς καὶ χρώμασι, κοινὸν πρὸς πληγὴν; [10]

- (24) Πληττόμενον μὲν ἦν ὁ ἄῃρ, πληγαὶ γὰρ τούτου οἱ ψόφοι· δι' ὧν δ' αἱ τούτων πληγαὶ ἀποτελοῦνται, ἔστι τὰ σώματα συγκρούοντα ἀλλήλοις καὶ δηλονότι καὶ αὐτὰ πληττόμενα, ὥσπερ ἐπὶ μὲν τῶν ἐκτὸς ἡμῶν λίθοι καὶ ξύλα καὶ τὰ ὅμοια, ἐφ' ἡμῶν δὲ καὶ τῆς ζωικῆς φωνῆς τὸ μὲν κατάρχον τῆς κινήσεώς ἐστιν ἡ ὀρμή ἢ πρὸς τὸ φωνεῖν, τὰ δὲ συνταράττοντα τὸ τε πνεῦμα τὸ φυσικόν, ὃ προφει τὸ ζῶον διὰ τῆς ἀρτηρίας καὶ
- (41) ἡ γλῶττα, ὃ τ' ἄῃρ ὁ τυπτόμενος. τοῦ μὲν φυσικοῦ πνεύματος διὰ τῆς ἀρτηρίας ὡς δι' αὐλοῦ ἐξιόντος, σχηματιζομένου δ' ὑπὸ τῆς γλῶττης ὡς τοῖς δακτύλοις τὸ ἐμφύσημα, τοῦ δ' ἄερος πληττομένου διὰ τὸ περιχεῦσθαι τὰ κρούοντα καὶ τὰ κρούμενα. ὅταν οὖν τὰ συγκρούοντα
- (5) σώματα τὰς πρῶτας καὶ φυσικὰς συστάσεις ἔχη διαφοροῦς, τουτέστιν ἢ μανὰ ὄντα ἢ πυκνὰ ἢ λεπτὰ ἢ παχεὰ ἢ λεῖα ἢ τραχεὰ ἢ πῶς ἐσχηματισμένα, ἰδίους ψόφους καὶ διαφοροῦς ἐξ ἀνάγκης ἀποτελεῖ. ταύτας μὲν τὰς διαφορὰς τῶν συστάσεων ὡς ἀποτελεσματικὰς πληγῶν διαφορῶν καὶ παθῶν ἐν ταῖς πληγαῖς παρηλλαγμένων εἰς τὴν προκειμένην παραληπτέον σκέψιν. οὐκ ἐτι γὰρ καὶ τὰς κατὰ τὰς παθητικὰς ποιότητας γινόμενας διαφορὰς τῶν σωμάτων παραληπτέον. παθητικὰς δὲ ποιότητας λέγει, ἃς καὶ Ἀριστοτέλης ἐν ταῖς Κατηγορίαις ὑπὸ τρίτον γένος τῆς ποιότητος ἔταξεν εἰπὼν·
- “Τρίτον δὲ γένος ποιότητος παθητικαὶ ποιότητες καὶ πάθη. ἔστι δὲ (15) τὰ τοιάδε, οἷον γλυκύτης καὶ στρυφνότης καὶ πάντα τὰ τούτοις συγγενῇ, ἔτι δὲ θερμότης καὶ ψυχρότης καὶ λευκότης καὶ μελανότης.” Εἰτά φησι· “παθητικαὶ δὲ ποιότητες λέγονται οὐ τῷ αὐτὰ τὰ δεδεγμένα τὰς ποιότητος πεπονθέναι τι. οὔτε γὰρ τὸ μέλι τῷ πεπονθέναι τι λέγεται

24 τούτου] τούτων p 25 αἱ om. p 27 τό add. ante τῆς M ζωικῆς] ζώσης B
28 συναράττοντα conl. Theiler 29 προῖη MEG προῖησι TV⁸⁷p

in lemmate: 7.6 τὰ om. M 7 μανόν ἕκαστόν ἐστιν MEp

15 τοιάδε] τοιαῦτα G post γλυκύτης add. τε καὶ πικρότης Ag 16 μελανότης] μελανία Ag.

The variation related to the things with which the impacts are made is found here in correspondence with the primary constitution of their body, the constitution, that is, which makes a thing diffuse or dense, thin or thick, smooth or rough, and again in correspondence with their shapes. As for their more affective¹⁴⁹ qualities, odours, I mean, and flavours and colours, what connection have they with impacts? Ptol. *Harm.* 7.5–10

We have seen that the air is something struck, for sounds are impacts on it. The things by means of which | their impacts¹⁵⁰ are produced are bodies clashing against one another, and plainly they too are things struck, for instance stones and pieces of wood and so on in the case of things external to us, while in our case and in that of the voice of living creatures the originator of movement is the impulse to utter, the items that jointly create the disturbance are the tongue and the natural breath which the animal propels through the windpipe, and the air is what is struck. The natural breath travels out through the windpipe as through an *aulos*; it is shaped by the tongue as is the in-blown breath by the fingers;¹⁵¹ and the air is struck because it is spread all around the things that strike and the things that are struck.¹⁵² Thus when the bodies that clash together | differ in their primary natural constitutions, that is, by being diffuse or dense or thin or thick or smooth or rough or shaped in some way, they necessarily produce characteristically different sounds. It is essential to bring these differences in constitution into our enquiry, as being productive of different impacts and distinct attributes | in the impacts; but we should not bring into it the differences between bodies that arise in correspondence with their affective qualities. By 'affective qualities' Ptolemy means those which Aristotle in the *Categories* classified under the third genus of quality, when he says: 'The third genus of quality is that of the affective qualities and attributes. These are | such things as sweetness and sourness and everything akin to them, and again hotness and coldness and whiteness and blackness.' Then he says:

[41D]

It is not because the things that acquire the qualities are affected in some way that they are called 'affective qualities'. For honey is not called sweet

¹⁴⁹ The adjective is *pathētikos*; see n. 153 below.

¹⁵⁰ The reference of 'their' must be to sounds; the sense is 'the impacts constituting sounds'.

¹⁵¹ The comparison is strange. The tongue 'shapes' the breath to produce, most notably, articulated syllables, but the fingering of a wind instrument changes only the pitches of the notes. I know of no other passage in which it is said or implied that the sounds 'shapes' can be altered by the use of the fingers. Cf. 42.6–22.

¹⁵² In the last sentence the verb used for 'striking' in 'the air is struck' is *plētein*; in 'the things that strike and the things that are struck' it is *krouein*; at the end of the previous sentence, in 'the air is what is struck', it is *tuplein*. See n. 147 above.

- γλυκύ, οὔτε τῶν ἄλλων τῶν τοιούτων οὐδέν. ὁμοίως δὲ τούτοις καὶ ἡ
 (20) θερμότης καὶ ἡ ψυχρότης παθητικαὶ <ποιότητες> λέγονται οὐ τῷ αὐτὰ
 τὰ δεδεγμένα πεπονθέναι τι, τῷ δὲ κατὰ τὰς αἰσθήσεις ἐκάστην τῶν
 εἰρημένων ποιότητων πάθους εἶναι ποιητικὴν παθητικὰ ποιότητες λέγον-
 ται. ἢ τε γὰρ γλυκύτης πάθος τι κατὰ τὴν γεῦσιν ἐμποιεῖ καὶ ἡ θερμό-
 της κατὰ τὴν ἀφήν, ὁμοίως δὲ καὶ αἱ ἄλλαι. λευκότητες δὲ καὶ μελανίαι
 (25) καὶ αἱ ἄλλαι δὲ χροαὶ οὐ τὸν αὐτὸν τρόπον τοῖς εἰρημένοις παθητικαὶ
 ποιότητες λέγονται, ἀλλὰ τῷ αὐταῖ ἀπὸ πάθους γεγενῆσθαι· γίνονται
 γὰρ διὰ πάθους πολλὰ μεταβολαὶ χρωμάτων.”
- Παθητικαὶ μὲν οὖν ποιότητες αἱ τοιαῦται καὶ ἔτι αἱ κατὰ τὰς εὐωδίας
 καὶ δυσωδίας τεταγμέναι. συλλαβὼν δὲ πάσας ὁ Πτολεμαῖος ἄτμους
 (30) μὲν ἔφη τὰς κατὰ τὰς δυσωδίας καὶ εὐωδίας καὶ ὅλως τὰς κατὰ τὴν
 ὄσφρησιν ποιοῦσας πάθη, χυμούς δὲ τὰς κατὰ τὴν γεῦσιν, χρώματα δὲ
 (42) τὰς κατὰ τὴν ὄρασιν. αὗται γὰρ πᾶσαι αἱ διαφοραὶ ἴδιοι οὔσαι τῶν εἰ-
 ρημένων αἰσθήσεων καὶ συζυγοῦσαι ὁράσει, γεύσει, ὀσφρήσει εἰκότως
 τῶν κατὰ τοὺς ψόφους πληγῶν εἶεν ἂν ἀλλότριαι, αἱ τῆς ἀκοῆς ἦσαν
 ἴδιοι. ἐκθέμενος οὖν τὰς χρησίμους <πρὸς> διαφορὰς τῶν ψόφων συστάσεις
 (5) ὑπάγει, ὃ ἐκάστη περιποιεῖν τοῖς ψόφοις πάθος δύναται.

περιποιεῖ δὲ διὰ μὲν τοῦ σχήματος ἐπὶ [10]

μὲν τῶν τὸ τοιοῦτον ἐπιδεχομένων, οἷον τῶν γλωσσῶν καὶ τῶν στομάτων,
 σχηματισμούς ὥσπερ τινὰς νόμους τοῖς ψόφοις, παρ’ οὓς ὀνοματοποιού-
 νται πάταγοι καὶ δοῦποι καὶ φωναὶ καὶ κλαγγαὶ καὶ μύρια ὅσα τοιαῦτα,
 μιμουμένων ἡμῶν ἐκάστους τῶν σχηματισμῶν τῷ λογικώτατον καὶ
 τεχνικώτατον ἡγεμονικὸν ἔχειν τὸν ἄνθρωπον· [15]

- (7) Ἡ κατὰ σχῆμα διαφορὰ κατηρίθμηται μὲν ἐν ταῖς διαφορὰν ἐμποιοῦ-
 σαις τοῖς ψόφοις. φησὶ δὲ μὴ πᾶσαν εἶναι πρὸς τοῦτο ἐπιτήδειον, μόνην
 δὲ τὴν κατὰ τὸ στόμα καὶ τὴν γλῶτταν ἐγγινομένην καὶ μάλιστα τῶν

20 <ποιότητες> ex Ar. 24 λευκότης δὲ καὶ μελανία Ar. 25 αἱ om. T δὲ om. Ar. 26 αὐταῖ
 αὐτὰς Ar. ἀπό] ὑπό g γεγενῆσθαι] γεγονέναι codd. Ar. praeter Coisl. 330, qui γεγενῆσθαι habet

1 ἴδιοι T 4 ἴδιοι T <πρὸς> add. Alexanderson 5 ὑπάγει] ἐπάγει conl. Düring

in lemmate: 7.11 τὸ τοιοῦτον] τοιούτων Mp 13 πάταγοι] πάγοι M

because it has been affected in some way, and nor are any other such things. In the same way | it is not because the things that receive the qualities have been affected in some way that hotness and coldness are called 'affective qualities', but they are called 'affective qualities' because each of the qualities mentioned is productive of an affect in the senses. For sweetness implants an attribute in the sense of taste and hotness in that of touch, and the others work in the same way. Instances of whiteness and blackness | and the other colours are not called 'affective qualities' on the same basis as those we have spoken of, but because they themselves arise from a being-affected; for many changes of colour arise through a being-affected.¹⁵³

Qualities of these sorts, then, are affective qualities, and so are those classified as good and bad smells. Ptolemy uses the term 'odours' to bring together all qualities | in the range of bad smells and good smells and in general the qualities that produce attributes in the sense of smell, 'flavours' for those related to taste, and 'colours' for those related to sight. For since all these differences are peculiar to the senses mentioned and are yoked together with sight, taste and smell, it is to be expected that they are irrelevant to the impacts involved in sounds, which are peculiar to hearing. Having set out, then, the different constitutions that have a bearing on sounds, | he goes on to say which attribute each of them can induce in the sounds.

[42D]

Through shape, in the case of things that admit such a variation, such as tongues and mouths, it makes configurations – regulations,¹⁵⁴ as it were – for the sounds, in correspondence with which names are coined such as clatters, thuds, voices, clangs and a thousand like them; and we ourselves imitate each of the configurations through man's possession of the most rational and skilful ruling principle. Ptol. *Harm.* 7.10–15

Difference in shape was numbered among those that induce a difference in the sounds. He says, however, that not all of them are effective for this purpose, but only the one that occurs in the mouth and the tongue,

¹⁵³ Aristotle *Cat.* 9a, with minor variations in the wording. The noun I translate in this passage first as 'an affect' and then as 'a being-affected' is *pathos*, cognate with the adjective *pathētikos*, 'affective'. In much of Porphyry's commentary the noun means merely 'an attribute' and I have translated it as such, but in this passage of Aristotle the more specific sense is required; a *pathos* is something passively undergone by an object or experienced by a conscious subject, a pain or an emotion, for instance. A form of the related verb *paschein* appears in the first sentence of this quotation, translated as 'are affected'.

¹⁵⁴ Ptolemy's use of the noun *nomoi* here is a little mysterious; Porphyry does not comment on it. The primary meanings of *nomos* are 'law', 'custom', 'convention'. It is also used to refer to a musical composition of a certain type, and it is possible, as Solomon suggests in his note ad loc., that Ptolemy intends some allusion to this usage. But it is not clear what the point of such an allusion could be.

- (10) ἀνθρώπων. παντοίως γὰρ σχηματίζειν τὴν γλῶτταν καὶ τὸ στόμα δυνάμεθα καὶ διαφόρους κατὰ τοῦτο ψόφους ἀποδιδόναι. σχηματισμὸς γὰρ ἐστὶ γλώττης καὶ στόματος, ὅταν φέρε κόρακας μιμώμεθα ἢ κορώνας ἢ γεράνους ἢ ἀετοὺς ἢ τι ἄλλο τῶν ὀρνέων ἢ τῶν ζώων ἢ ἑτερογλῶττων φωνὰς ἢ λίθων ἀραγμοὺς ἢ ψόφους ἀλλοίους ἢ δούπους ἢ βρόμους πεφυκότες πρὸς παντοῖον σχηματισμὸν διὰ τὴν τοῦ ἡγεμονικοῦ ἡμῶν εὐμίμητον φύσιν. ἀλλ' ὃ γε ποιὸς σχηματισμὸς τῆς γλῶττης καὶ τοῦ στόματος οὐκ ἦν ὀξύτητος ἢ βαρύτητος ψόφων κατ' αὐτὸ τοῦτο ὑποστατικός, ἀλλ' ὥσπερ φησὶ σχηματισμοῦ μόνον τοῖς ψόφοις αἴτιος, οὓς σημαινόμενοι ὀνομάζομεν ἰδίως πατάγους καὶ δούπους καὶ φωνὰς καὶ κλαγγὰς καὶ
- (15) τινὰ ὀνοματοποιούντες τοιαῦτα, οὐ μὴν ἔτι καὶ ὀξύτητας καὶ βαρύτητας ὀνομάζοντες, ὡς <τὸ> τῇ κατὰ σχῆμα διαφορᾷ τῶν τοιῶνδε σχηματίζεσθαι οὐκ ἦν ὀξύτητος καὶ βαρύτητος τῆς ζητουμένης ἀποτελεσματικόν. διὸ καὶ αὕτη ἡ διαφορὰ τῶν σωματικῶν παρείσθω συστάσεων.

διὰ δὲ τὴν τῆς λειότητος [15]

ἡ τραχύτης ποιότητα μόνην πάλιν, καθ' ἣν ὁμωνύμως λέγονται λεῖοι τινες ἢ τραχεῖς, ὅτι καὶ αὗται ποιότητές εἰσι κυρίως

- (25) Ἡ λειότης φησὶ τῶν σωμάτων καὶ ἡ τραχύτης ποιότητές εἰσι μόνον κυρίως. παρὰ δὴ ταύτας αἱ γινόμεναι πληγαὶ τῶν σωμάτων τοὺς ψόφους ποιοὺς μόνους ἀπεργάζονται· ἡ γὰρ λείους ἢ τραχεῖς αὐτοὺς ἀποτελοῦσιν, οὐ μὴν βαρεῖς ἢ ὀρεῖς. ὅτι δὲ καὶ ἡ λειότης καὶ ἡ τραχύτης ποιότητές εἰσι, μονονουχὶ δὲ τὴν σύστασιν ἐν ποσῷ κεκτημέναι, Ἀριστοτέλης ἐν ταῖς Κατηγορίαις ἐφίστησι.
- (30) “Τὸ δὲ μανὸν καὶ τὸ πυκνὸν καὶ τὸ τραχὺ καὶ τὸ λεῖον δόξειε μὲν ἂν ποιοῖν τι σημαίνειν· ἦν δ' ἀλλότρια ταῦτα τῆς περὶ τὸ ποιοῖν διαιρέσεως. θέσιν γὰρ τινὰ φησι φαίνεται μᾶλλον τῶν μορίων ἐκάτερον δηλοῦν. πυκνὸν μὲν γὰρ τῷ τὰ μόρια σύνεγγυς εἶναι ἀλλήλοις, μανὸν δὲ τῷ διεσθάναι
- (43) ἀπ' ἀλλήλων, καὶ λεῖον μὲν τῷ ἐπ' εὐθείας πῶς τὰ μόρια κεῖσθαι, τραχὺ δὲ τῷ τὸ μὲν ὑπερέχειν, τὸ δ' ἐλλείπειν.”
- Ἡ πρῶτον μὲν οὐ ταῖς διαστάσεσι ταῖς ἀπ' ἀλλήλων καὶ τῷ μὲν <πόρρω τῷ δ'>

14 ἀλλοίους om. T ἡ δούπους om. p 17 ὑποστατικός T 21–22 locus corruptus Alexanderson
21 <τὸ> addidi 22 ἀποτελεσματικόν scripsi ἀποτελεσματικὴ codd. 29 ποσῷ] θέσει malim

1 δέ om. m 2 τί om. m ἦν – ταῦτα] ἔοικε δὲ ἀλλότρια τὰ τοιαῦτα εἶναι Ag. 3 θέσιν γὰρ
μᾶλλον τινὰ φαίνεται τῶν Ag. 4 τῷ^{sec.}] τό m 5 ἀπ'] ἐπ' T πῶς om. m 7 διαστάσεσι]
συστάσεσι g <πόρρω τῷ δ'> conieci

in lemmate: 7.15 τὴν om. p

especially in those | of humans. For we can shape the tongue and the mouth in all sorts of ways, and by these means can emit different sounds. There is a shaping of the tongue and the mouth, for instance, when we imitate crows or rooks or cranes or eagles or other birds or animals, or the voices of foreigners or the clatter of rocks or sounds of other sorts or thuds or roars, | since we are naturally equipped to produce every kind of shaping through the skilfully imitative nature of our ruling principle. But a specific kind of shaping of the tongue and the mouth is not responsible, as such, for the height or depth of the sounds. Rather, as Ptolemy says, it is the cause only of the shaping of the sounds which we indicate by giving them special names, 'thuds' and 'voices' and 'clangs' and | others of that sort which we name by onomatopoeia. But we do not do this to name heights and depths of pitch, since shaping through the differences in shape associated with attributes such as those is not productive of the height and depth we are seeking.¹⁵⁵ Thus this difference in bodily constitution can also be passed over.

Through smoothness and roughness, again, it creates only a quality in accordance with which sounds are described by the same words, smooth or rough, since the qualities are essentially the same. Ptol. *Harm.* 7.15–17

| He says that the smoothness and roughness of bodies are fundamentally qualities. Through these, the impacts of bodies that occur give the sounds only qualities, for they make them smooth or rough but not low pitched or high. Aristotle in the *Categories* asserts that smoothness and roughness are qualities, except that the composition they possess | consists in quantity.¹⁵⁶ 'The diffuse and the dense and the rough and the smooth would seem to indicate some quality; but they are alien to the division concerned with quality. For each of them,' he says, 'evidently displays rather some placement of the parts. For a thing is dense because its parts are close to one another and diffuse because they are separated | from one another; and it is smooth because its parts lie somehow along a straight line, and rough because one part is higher and another lower.'¹⁵⁷

[43D]

Now in the first place the diffuse and the dense do not consist in the separation <of the parts> from one another, and in their being far apart

¹⁵⁵ This seems to be the sense intended, though something is wrong with the MSS text, as Alexanderson notes, and I am not sure that my emendations adequately resolve the problem.

¹⁵⁶ This translates the text of the MSS, but a glance at the quotation that follows shows that it is not what Aristotle says; nor is it the thesis that Porphyry goes on to discuss in the immediate sequel. I suspect that what Porphyry wrote was not *en posōi*, 'in quantity', but *en thesei*, 'in position'.

¹⁵⁷ Aristotle *Cat.* 10a.

- ἐγγύς τὸ μανὸν καὶ τὸ πυκνόν, οὐ δὲ τραχύτης καὶ λειότης πανταχοῦ ἐξ ἀνωμαλίας θέσεως καὶ ὁμαλότητος. δεύτερον δὲ δύναται ἄρχειν μόνη
- (10) τοπικὴ θέσις, ἕτερον δ' ἐπ' αὐτῆς τὸ γινόμενον εἶναι, ὥσπερ καὶ ἐπὶ ταῖς αὐξήσεσιν ἂν τις εὕροι ἄρχουσαν μὲν τὴν τοπικὴν, ἐπιγινομένην δὲ τὴν κατὰ τὸ ποσὸν κίνησιν. οὕτως οὖν καὶ ἐνταῦθα ἡγεῖται μὲν ἡ θέσις, ἔπεται δ' ἡ ποιότης ἀλλοιώσεως οὕσα τοῦ ὑποκειμένου. εἰ γὰρ μὴ τοῦτο λέγομεν, ἀλλ' ὅλως τὴν ἀραίωσιν καὶ τὴν πύκνωσιν σύγκρισιν καὶ διάκρι-
- (15) σιν τιθῶμεν ἢ ἐκ τούτων ὅλως εἶναι, καὶ τὴν τραχύτητα καὶ λειότητα τῇ τῶν μορίων προσάπτομεν θέσει, καὶνὸν ἂν ἐξ ἀνάγκης παραδεχοίμεθα ποιότητες οὖν καὶ αὗται. καὶ ὀρθῶς τῷ μουσικῷ εἴρηται τὰ περὶ τούτων, ἀλλ' ἡμεῖς μὲν καὶ τὸ λεῖον καὶ τὸ τραχὺ καὶ τὸ μανὸν καὶ τὸ πυκνὸν ποιά εἶναι εἰρήκαμεν· ὁ δὲ τὸ μὲν λεῖον καὶ τὸ τραχὺ συγχωρεῖ μόνον
- (20) εἶναι ποιά, τὸ δὲ μανὸν καὶ τὸ πυκνὸν μὴ μόνον ποιά, ἀλλὰ καὶ τοῦ ποσοῦ μετέχειν ἀποφαίνεται γράφων οὕτως.

διὰ δὲ τῆς μανότητος

ἢ πυκνότητος καὶ τῆς παχύτητος ἢ λεπτότητος ποιότητος, καθ' ἃς πάλιν ὁμωνύμως λέγομεν τινὰς ψόφους πυκνοὺς ἢ χαυνοὺς, καὶ παχεῖς ἢ ἰσχνοὺς καὶ ἔτι βαρύτητας ἐνταῦθα καὶ ὀξύτητας, ὅτι καὶ τῶν εἰρημένων [20] συστάσεων ἑκάτερα ποιότης οὕσα παρὰ τὸ ποσὸν γέγονε τῆς οὐσίας.

- (23) Τὰ μανὰ καὶ πυκνὰ καὶ παχεῖα ἢ λεπτὰ δύο φησὶ διαφορὰς ἀποτελεῖν τῶν ψόφων. καὶ γὰρ ποιοὺς αὐτοὺς ποιεῖν, καθ' ὃ λέγομεν ὁμωνύμως
- (25) τινὰς ψόφους πυκνοὺς ἢ χαυνοὺς καὶ παχεῖς ἢ ἰσχνοὺς, ποιεῖν δὲ τὰ εἰρημένα καὶ ὀξεῖς ἢ βαρεῖς τοὺς ψόφους. καὶ ποιότητες οὖν ἀποτελοῦν-

12 ante ἐνταῦθα add. τὰ g 14 λέγομεν T 16 καίνον] κενόν G κανών p κοινόν Wallis
23 μανὰ] μανικά T

in lemma: 7.17 ante τῆς add. τὴν ME 18 ποιότητα ME

and close together,¹⁵⁸ and nor do roughness and smoothness always arise from the unevenness and evenness of their placement.¹⁵⁹ Secondly, position in place can be | the sole origin while what results from it is something else, just as in cases of growth one will find that change in place is the origin, but the result is a change in quantity. Thus position takes the lead in this case too, but what follows is a quality which is an alteration of the underlying thing. For if we do not say this, but treat rarefaction and compaction as consisting wholly in drawing together and drawing apart, | or as arising wholly from them, and attach roughness and smoothness to the placement of the parts, we shall inevitably be adopting a novel view. Thus they are qualities, and the musical theorist [i.e. Ptolemy] is correct in what he said about them. But while we have said that the smooth and the rough and the diffuse and the dense are qualitative, he agrees, on the one hand, that the smooth and the rough are only | qualitative, but on the other hand shows, when he writes as follows, that the diffuse and the dense are not only qualitative but also have a share in the quantitative.¹⁶⁰

Through diffuseness or density and thickness or thinness it makes qualities in accordance with which we again call sounds by the same words, dense or flabby, thick or thin; and from here it also makes high and low pitches,¹⁶¹ since each of the compositions mentioned is a quality, but comes about in correspondence with the quantity of substance. Ptol. *Harm.* 7.17–21

Things that are diffuse or dense and thick or thin, he says, produce two differences in sounds.¹⁶² For he says that they give them qualities in accordance with which we use the same names when speaking | of sounds as dense or flabby and as thick or thin, but that the things mentioned also

¹⁵⁸ My supplement to the Greek text here (corresponding to 'far apart and' in the translation) was prompted by an anonymous reader, who pointed out that some such addition is needed to complete the sense and the syntactical structure.

¹⁵⁹ Porphyry's grounds for denying these propositions are obscure; he may be relying on Plot. *Enn.* VI.1.11.24–8, where much the same remarks appear. Both writers can argue that these qualities do not *consist in* such placements of parts, but they both deny also that roughness and smoothness always *arise from* these placements, a thesis which seems much harder to defend. The fact that they both go on to assert that roughness and smoothness can still be qualities even if they do arise from arrangements of parts may suggest some uneasiness about their previous contentions.

¹⁶⁰ For arguments to show that in a certain sense an attribute can belong to both of two different categories see Aristotle *Cat.* 11a, followed and elaborated by Porphyry at *In Cat.* 140.22–141.4.

¹⁶¹ The nouns used here, *barytēs* and *oxytēs*, are the regular terms for 'low pitch' and 'high pitch'. But here and in the sequel their literal meanings, 'heaviness' and 'sharpness', clearly come into play, and parts of the text are unintelligible unless those senses are placed in the foreground. The metaphors of height and depth common to most modern languages are rare in Greek sources and play no part in the present discussion. From this point in the text to 61.14 I have therefore added reminders of these senses in brackets, in places where they seem particularly relevant.

¹⁶² On the whole passage from here to 67.14 see Introduction Section 4(b).

ται ἐν τοῖς ψόφοις ὁμώνυμοι ταῖς τῶν τοιούτων σωμάτων ποιότησιν.
ἀλλὰ καὶ βαρύτητες ἐνταῦθα, τουτέστιν ἐπὶ τούτων, καὶ ὀξύτητες, τὰς δ'

- (44) ὀξύτητας καὶ βαρύτητας, εἴ τε ποιότητές εἰσιν, εἴ τ' ἄλλο τι, οὐδέπω
μὲν γνωρίμων ἀπὸ τῶν ῥηθέντων. δειχθέντος δὲ παρὰ τί ἀποτελοῦνται,
σαφεῖς καθίστανται ἐν ποίῳ γένει τυγχάνουσιν οὔσαι. τῶν δ' εἰρημέ-
(5) νων συστάσεων ἑκατέραν φησὶ μίαν μὲν τιθεῖς συστοιχίαν μανότητα καὶ
πυκνότητα, ἑτέραν δὲ παχύτητα καὶ λεπτότητα. ἑκατέραν οὖν φησι
τούτων τῶν συστάσεων ποιότητα μὲν εἶναι, ἀποτελεῖσθαι δὲ παρὰ τὸ
ποσὸν τῆς οὐσίας. διὸ καὶ ποιῶν γίνεσθαι αἰτίας καὶ ποσῶν, τῶν μὲν
ποιῶν κατὰ τὸ πυκνοῦς ἢ μανοῦς γίνεσθαι ἢ παχεῖς ἢ λεπτοῦς τοὺς ψό-
(10) φους θεωρουμένων, τῶν δὲ ποσῶν κατὰ τὸ βαρεῖς ἢ ὀξεῖς. δηλον οὖν ὡς
ἡ βαρύτης τῶν φθόγγων καὶ ἡ ὀξύτης εἰς τὴν ποσότητα ἀναχθῆσεται.
τοῦτο δ' οὐ πάντως, φαίη ἂν τις, συνάγεσθαι ἐκ τοῦ λόγου, ἀλλ' ὥσπερ
τὸ ποσὸν οὐκ ἐκωλύετο τῆς οὐσίας ποιότητος γίνεσθαι αἷτιον, οὕτως εἰ
τὸ ποσὸν αἷτιον τῆς ὀξύτητος καὶ τῆς βαρύτητος, οὐ πάντως ποσὰ ἢ
ὀξύτης καὶ ἡ βαρύτης. ἐνδέχεται γὰρ εἶναι ποιὰ, ἐπεὶπερ κεῖται οὐ
(15) ποσῶν μόνον, ἀλλὰ καὶ ποιῶν τὸ ποσὸν τῆς οὐσίας γίνεσθαι αἷτιον. ὅτι
γὰρ διὰ ποσότητος τῆς οὐσίας αἱ εἰρημέναι ποιότητες ἀπετελέσθησαν,
αὐτὸς διδάσκει γράφων τάδε.

**πυκνότερον γάρ ἐστι τὸ ἐν ἴσῳ ὄγκῳ πλείονα ἔχον οὐσίαν, καὶ παχύτερον
τῶν ὁμοιοσυστάτων τὸ ἐν ἴσῳ μήκει πλείονα ἔχον οὐσίαν.**

- (19) Οὕτω γὰρ καὶ ἄλλοι ὥρισαντο· τὸ μὲν πυκνόν, οὗ σύνεγγυς ἀλλήλων
(20) τὰ μόρια ἀποδιδόντες, τὸ δὲ μανόν, οὗ διεστῶτα, καὶ συγκρίσεισι καὶ
διαθέσειν ἀναθέντες τὰς μανώσεις καὶ πυκνώσεις. καὶ αὐτὸς τοῖνον
ὡσαύτως ἀποδέδωκε πυκνότερον εἰπὼν ἕτερον ἑτέρου, ὅταν ὁ μὲν ὄγκος
ἴσος ᾗ καὶ ὁ αὐτός, πλείων δ' ἢ θατέρου οὐσία τῆς τοῦ ἑτέρου. οὕτω
γὰρ συμβαίνει διὰ τὸ τὰ <τοῦ μὲν> μόρια σύνεγγυς εἶναι ἀλλήλων, τοῦ
(25) δὲ μή, τὸ μὲν πλείω ἔχειν οὐσίαν, τὸ δ' ἐλάττω τοῦ αὐτοῦ ὄντος ὄγκου.
πάλιν παχύτερον ἐν τοῖς ὁμοιοσυστάτοις λέγομεν, οἷον χορδὴν χορδῆς
παχυτέραν καὶ ἀνθρωπον ἀνθρώπου παχύτερον ἢ ξύλον ξύλου, ὅταν τὸ
μὲν μήκος ἴσον ᾗ, πλείων δ' ἢ οὐσία τοῦ ἑτέρου. ἢ κατὰ ποσὸν οὖν τῆς
οὐσίας διαφορά τὸ πυκνὸν καὶ τὸ μανὸν καὶ τὸ λεπτόν καὶ τὸ παχὺ ὑπέ-
(30) στησε, καὶ εἰσι ποιότητες ἢ μανότης καὶ ἡ πυκνότης καὶ ἡ λεπτότης

27 ἐν τοῖς] αὐτοῖς Mg

5 οὖν] οὐσαν g 15 ποσῶν – ποιῶν] ποσόν – ποιόν MEG 20 ἀποδόντες T 23 πλείω
ETV¹⁸⁷ 24 τὸ om. ETV¹⁸⁷ <τοῦ μὲν> add. Wallis 26 ὁμοιοστάτοις p 28 πλείον p
29 ἐπέστησε T

in lemma: 7.22 τὸ ἐν ἴσῳ ὄγκῳ πλείονα ἔχον οὐσίαν om. M 23 τὸ] τῷ M

make the sounds high (sharp) or low (heavy). Thus qualities are produced in sounds with the same names as the qualities of such bodies; but low and high pitches also arise there, that is, supervening upon them, and whether depth and height of pitch are qualities or something else is not yet known on the basis of what has been said. But once that by which they are produced has been shown, the kind of class they are in is clearly established. In speaking of each of the constitutions mentioned he treats diffuseness and | denseness as one pair and thickness and thinness as the other. Each of these constitutions, he says, is a quality, but it is produced by the quantity of the substance. Thus they are causes of both qualities and quantities, of items considered as qualities in so far as the sounds become dense or diffuse or thick or thin, and as quantities in so far as they become low (heavy) or high (sharp). It is clear, then, | that the depth and height of notes will be brought into the class of quantity.

[44D]

But, someone might say, this does not altogether follow from the argument. Just as there was nothing to prevent the quantity of substance from being the cause of a quality, so if quantity is the cause of height and depth of pitch, it is not inevitable that height and depth are quantities. For it is possible that they are qualities, since it is laid down that the quantity of substance is not | the cause only of quantities but also of qualities. Ptolemy himself teaches that the qualities mentioned are produced by the quantity of substance, in the following words.

For a denser thing is one that has more substance in an equal bulk, and a thing that is thicker than things of the same constitution is one having more substance in an equal length. Ptol. *Harm.* 7.22–3

Others too have defined them in this way, asserting that the dense is that whose parts | are close to one another and the diffuse is that whose parts are separated, and attributing rarefactions and condensations to drawing together and separating. Ptolemy has thus given a similar account in saying that one thing is denser than another when their bulk is the same but there is more substance in one of them than the other. For it is by the parts of the former being close to one another, whereas those of the latter | are not, that the former contains more substance and the latter less, though its bulk is the same. Again, we speak of a 'thicker' among things that are similarly constituted, as one string is thicker than another string, a man than a man or a log than a log, when the length is equal but there is more substance in one of them. Thus a difference in the quantity of substance underlies the dense and the diffuse and the thin and the thick, | and diffuseness and denseness and thinness and thickness are qualities. Thus nothing prevents a

[45D]

- (45) καὶ ἡ παχύτης. οὐδὲν οὖν κωλύει τὸ ποσὸν αἴτιον ποιότητων γίνεσθαι, ὥστ' οὐ συνάγεται τὸ τὴν ὀξύτητα καὶ βαρύτητα εἶναι ποσότητος, ἐπεὶ τὸ ποσὸν τῆς οὐσίας αὐτῶν αἴτιον γίνεται. ἴδωμεν δὲ καὶ ἃ ἐπάγει.

καὶ ἔστι τοῦ

μὲν ὀξυτέρου περιποιητικὰ τὸ πυκνότερον καὶ τὸ λεπτότερον, τοῦ δὲ βαρυτέρου τὸ μανότερον καὶ τὸ παχύτερον. [25]

- (5) ὥστε τῶν συζυγιῶν, λέγω δὲ συζυγίας μὲν πυκνότητα καὶ μανότητα, ἑτέραν δὲ λεπτότητα καὶ παχύτητα, τὰ μὲν ἕτερα μέρη ὀξύτητος, τὰ δ' ἕτερα βαρύτητος γίνεσθαι αἴτια, τὴν μὲν πυκνότητα καὶ τὴν λεπτότητα ὀξύτητος, τὴν δὲ μανότητα καὶ παχύτητα βαρύτητος. οὐκέτ' οὖν, φῆσαι ἂν τις πρὸς αὐτόν, οὐδὲ παρὰ τὸ ποσὸν τῆς οὐσίας ἀποτελεῖται ἡ ὀξύτης
- (10) καὶ ἡ βαρύτης, ἀλλὰ παρὰ τὰς ποιότητας. παρὰ μὲν γὰρ τὸ ποσὸν τῆς οὐσίας ἡ πυκνότης καὶ ἡ λεπτότης καὶ ἡ μανότης καὶ ἡ παχύτης ἀπετελοῦντο καὶ ἦσαν οὐ ποσότητες κατ' αὐτόν τοῦτον, εἰ καὶ ἐκ ποσότητος ἐγίνοντο, ἀλλὰ ποιότητες. αὗται δὲ ποιότητες οὔσαι αἰτίαι γίνονται τῆς ὀξύτητος τῶν φθόγγων καὶ τῆς βαρύτητος. ὥστ' ἐξ ἀνάγκης, εἴπερ αἱ
- (15) ποιότητες ποιότητων εἰσὶν ἀποτελεστικά, ποιότητας εἶναι καὶ τὰς ὀξύτητας καὶ τὰς βαρύτητας, αἶ γε κἂν, εἰ παρὰ τὸ ποσὸν τῆς οὐσίας ὑφίσταντο, οὐκ ἐκωλύοντο εἶναι ποιότητες. τὴν τοίνυν ἔφοδον παραιτητέον, ἣ κέχρηται ὁ Πτολεμαῖος. χρηστέον δὲ τοῖς ὑπὸ τῶν παλαιῶν εἰρημένοις, ἃ συμπληρώσαντες τὴν ἐξήγησιν τῶν ὑπὸ τούτου εἰρημένων
- (20) παραθήσομεν.

ἤδη δὲ καὶ ἐν τοῖς ἄλλοις [25]

τὸ ὀξύτερον τῷ λεπτότερον εἶναι λέγεται τὸ τοιοῦτον, ὥσπερ καὶ τὸ ἀμβλύτερον τῷ παχύτερον. πλήττει γὰρ ἀθρούτερον τὰ μὲν λεπτότερα παρὰ τὸ θάττον διικνεῖσθαι δύνασθαι, τὰ δὲ πυκνότερα παρὰ τὸ μᾶλλον

- (22) Ταύτῃ τῇ αἰτίᾳ καὶ οἱ παλαιοὶ ἐχρῶντο, ἐφ' ἣν μεταβέβηκε παρεῖς τὴν προτέραν. τὴν γὰρ ταχυτῆτα αἰτίαν τῆς ὀξύτητος ἀπεδίδουσιν καὶ τὴν βραδυτῆτα τῆς βαρύτητος. καὶ εἴπερ ἐν ποσῷ ἡ ταχυτῆς καὶ ἡ βραδυτῆς, αἴτιον μὲν τὸ ποσὸν ὀξύτητος καὶ βαρύτητος δοίη ἂν τις. οὐ μὴν πάντως ἐκ τούτου τοῦτο συνάγεται τὸ εἶναι τοῦ ποσοῦ τὴν ὀξύτητα καὶ τὴν βαρύτητα. εἰ μέντοι ὥς οἶεται Ἀριστοτέλης καὶ ὁ Πλάτων οὐκ αἴτιον τὸ ταχὺ ἐτίθετο τοῦ ὀξέος, ἀλλ' αὐτὸ τὸ ὀξύ ταχὺ καὶ αὐτὸ τὸ βαρὺ βραδύ, εἴη ἂν τοῦ ποσοῦ τὸ ὀξύ καὶ βαρὺ, εἴπερ ποσὰ τὸ ταχὺ καὶ τὸ
- (30) βραδύ. ἵνα δὲ σαφὴς γένηται ἡ τε Πλάτωνος καὶ Ἀριστοτέλους δόξα καὶ μέντοι καὶ τὰ ὑπὸ τούτου λεγόμενα ἔτι μᾶλλον ἀναπτυχθῇ τῆς τε

quantity from being the cause of qualities; and hence it does not follow that because their cause is the quantity of substance, sharpness and heaviness are quantities. But let us see what Ptolemy says next.

The denser and the thinner are productive of the higher (sharper), the more diffuse and thicker of the lower (heavier). Ptol. *Harm.* 7.23–5

| Thus of each of the pairs, by which I mean denseness and diffuseness on the one hand and thinness and thickness on the other, one part is a cause of height (sharpness) and the other of depth (heaviness), denseness and thinness of height, diffuseness and thickness of depth. One might therefore say in opposition to Ptolemy that height and depth are not even produced by the quantity of substance, | but by the qualities. For we saw that denseness and thinness and diffuseness and thickness are produced by the quantity of substance, and that even in his opinion they are not quantities, even though they arise from quantities, but are qualities. And it is these, which are qualities, that are the causes of the height and depth of notes. Necessarily, then, if indeed | qualities are productive of qualities, height and depth must be qualities; and nothing would prevent them from being qualities even if they were dependent on the quantity of substance. Thus the approach that Ptolemy adopts should be rejected, and we should make use of the things said by the ancient writers, which we shall append to fill out the exposition of what | Ptolemy has said.

In all other things too, the sharper is described as such because it is thinner, just as is the blunter because it is thicker. For thinner things strike more compactly because they can penetrate more quickly, and denser things because they penetrate further. Ptol. *Harm.* 7.25–8

The ancient writers also made use of this cause, to which Ptolemy has shifted leaving the former causes aside; for they asserted that swiftness is the cause of high pitch (sharpness) and slowness of low (heaviness). And since swiftness and slowness consist in quantity, | one might grant that quantity is the cause of high and low pitch. Yet from this it does not follow that high and low pitch belong to the class of quantity; whereas if he had not represented swiftness as the cause of high pitch, but had said that the high itself is swift and the low itself is slow, as Plato and Aristotle thought,¹⁶³ the high and the low would indeed belong to the class of quantity, since the swift and the slow | are quantities. In order to clarify the opinion of Plato and Aristotle, and to unravel still further what Ptolemy says and to

¹⁶³ In fact, as Porphyry explains later (48.10–18), this is not what Aristotle thought.

- (46) προσηκούσης εξετάσεως τύχη, φέρε τὰ τοῦ Πλάτωνος καὶ τὰ τοῦ Ἀριστοτέλους περὶ τούτων ῥηθέντα παραθώμεθα.

Ὁ δὲ Πλάτων ἐν τῷ Τιμαίῳ περὶ τε φωνῆς καὶ ἀκοῆς διαφορὰς τε φωνῆς διαλεγόμενος γράφει ταῦτα.

- (5) “Τρίτον δ’ αἰσθητικὸν ἐν ἡμῖν μέρος ἐπισκοποῦσι τὸ περὶ τὴν ἀκοήν, δι’ ἧς αἰτίας τὰ περὶ αὐτὸ ζυμβαίνει παθήματα, λεκτέον. ὅλως μὲν οὖν φωνὴν θῶμεν τὴν δι’ ὧτων ὑπ’ ἀέρος ἐγκεφάλου τε καὶ αἵματος μέχρι ψυχῆς πληγὴν διαδιδομένην, τὴν δ’ ὑπ’ αὐτῆς κίνησιν, ἀπὸ τῆς κεφαλῆς μὲν ἀρχομένην, τελευτῶσαν δὲ περὶ τὴν τοῦ ἥπατος ἕδραν, ἀκοήν· ὅση
- (10) δ’ αὐτῆς ταχεῖα, ὀξεῖαν, ὅση δὲ βραδυτέρα, βαρυτέραν· τὴν δὲ μίαν ὁμαλὴν τε καὶ λείαν, τὴν δ’ ἐναντίαν τραχεῖαν· μεγάλην δὲ τὴν πολλήν, ὅση δ’ ἐναντία, σμικράν. τὰ δὲ περὶ ζυμφωνίας αὐτῶν ἐν τοῖς ὕστερον λεχθησομένοις ἀνάγκη ῥηθῆναι.”
- Ἐν δὲ τούτοις ὁ Πλάτων τὴν μὲν φωνὴν ἔφη εἶναι πληγὴν, ὑπ’ ἀέρος
- (15) μὲν γινομένην, δι’ ὧτων δὲ καὶ ἐγκεφάλου καὶ αἵματος μέχρι ψυχῆς διαδιδομένην, ὥστε—τῆς πληγῆς διχῶς λεγομένης κατὰ τε τὸ πλήττειν, ὃ ἐστὶν ἐνεργεῖν εἰς ἄλλον, ὡς λεγόμεθα πληγὰς διδόναι τοῖς οἰκέταις, κατὰ τε τὸ πλήττεσθαι, ὃ ἐστὶ πάσχειν ὑπ’ ἄλλου, ὡς λέγονται πληγὰς ἔχειν οἱ τυπτηθέντες—ὁ Πλάτων πληγὴν ἀέρος ἀποδέδωκε τὴν
- (20) φωνήν, οὐ τὴν κατὰ τὸ πεπληῆσθαι τὸν ἀέρα λέγων πληγὴν, ἀλλὰ τὴν κατὰ τὸ πλήσσειν καὶ αὐτὸν ἐνεργεῖν τὴν πληγὴν εἰς τοὺς ἀκούοντας. οὐ γὰρ ἔφη πληγὴ ἀέρος, ἀλλὰ πληγὴ ὑπ’ ἀέρος, τὴν κατὰ τὸ ἐνεργεῖν πληγὴν ἀέρος λαμβάνων, οὐ τὴν κατὰ τὸ πάσχειν αὐτὸν καὶ πλήττεσθαι. ὁ δὲ οὐκ οἶδα, ὅπως οὐ συνείδον οἱ Πλατωνικοὶ πάντες ἀπαξαπλῶς πλη-
- (25) γὴν ἀέρος κατὰ Πλάτωνα ἀποδόντες τὴν φωνήν, οὐ τὴν κατὰ τὸ αὐτὸν πλήσσειν ἡμᾶς ὑπακουομένην, ὡς Πλάτων τίθησι, τὴν δὲ κατὰ τὸ αὐτὸν πεπληῆσθαι τὸν ἀέρα πληγὴν ἀέρος ἐξηγούμενοι, ὁ διὰ τῆς ἐκκειμένης λέξεως οὐκ εἴρηκεν ὁ Πλάτων. ἔξωθεν γὰρ ἦν συλλογίζεσθαι καὶ οὐκ ἐκ τῶν εἰρημένων ἐξακούειν, ὅτι πλήσσει ἡμῶν τὴν αἴσθησιν ὁ ἀήρ
- (30) πληγεῖς καὶ αὐτὸς πρότερον καὶ διαφέρων τὴν πληγὴν εἰς ἡμᾶς. ἐν μὲν δὲ τοῦτο ἐπισεσημάνθω, δεύτερον δ’ ὅτι τὴν ὑπ’ ἀέρος πληγὴν διαδιδομένην εἰς ψυχὴν καὶ <δι> ὧτων καὶ ἐγκεφάλου καὶ αἵματος ὡς ὀργάνων

6 αὐτό e corr. cod. Paris 1807 Pl. *Tim.* αὐτά codd. et codd. Pl. 10 ὀξεῖαν – βαρυτέραν e Pl. μίαν] ὁμοίαν codd. et cod. Pl. Paris 1807 21 αὐτόν] αὐτὸ τὸ Düring 25 ἀποδιδόντες p 26 ἐπακουομένην p 29 ὅτι G δ ceteri 32 <δι> add. Wallis ὡς] καὶ T ὀργανων g

give it a fitting explication, let us set down what Plato and Aristotle said about these matters. [46D]

In the *Timaeus*, when he is discussing voice and hearing and difference of voice, Plato writes as follows:

| When considering the third of our parts that is capable of sensation, that to do with hearing, we must say what are the causes through which its experiences come about. Let us take it that sound in general is an impact made by air, coming through the ears and impinging on the brain and the blood, and passed on as far as the soul; and that hearing is a movement caused by it, beginning in the head and ending in the region of the liver. Any instance | of it that is swift is high, and any that is slower is lower. That which is homogeneous is even and smooth, while the opposite sort is rough. A large amount is loud, the opposite kind quiet. Matters to do with concords must be spoken of in the course of what I shall say later.¹⁶⁴

In these remarks Plato said that voice is an impact | made by air, transmitted through the ears, brain and blood as far as the soul. Now an impact is spoken of in two ways, both in correspondence with striking, which is acting on something else (as when we speak of ‘inflicting impacts’ on slaves), and in correspondence with being struck, which is undergoing something through the agency of another (as people who have been beaten are said to ‘have impacts’);¹⁶⁵ so when Plato represented voice as an impact of air, | he was not referring to the impact corresponding to the air’s having been struck, but to that corresponding to its striking, and to its actively making an impact on the hearers. For he did not say ‘an impact of air’ but ‘an impact made by air’, referring to the impact of air corresponding to its activity and not to that corresponding to its undergoing something and being struck. I really do not know why virtually all the Platonists failed to grasp this, | and asserted that according to Plato the voice is an ‘impact of air’, not interpreting the ‘impact of air’ as the one understood in correspondence to its striking us, as Plato represents it, but as the one corresponding to the air itself having been struck, which Plato did not say in the statement quoted. For their thesis that the air which strikes our sense-perception | has itself previously been struck, and transmits the impact to us, was based on reasoning from something external, and not on paying close attention to what Plato had said.

Let this, then, be one indication. A second is that he says that the impact made by air is transmitted to the soul through the ears, brain and blood as

¹⁶⁴ Plato *Timaeus* 67a–c.

¹⁶⁵ The awkward phrases in inverted commas are perfectly natural in Greek.

- (47) ἐμποιεῖν φησιν ἐν ἡμῖν κίνησιν, ταύτην δ' εἶναι τὴν κίνησιν ἀκοὴν τὴν ὑπὸ τῆς πληγῆς τῆς διαδοθείσης εἰς ψυχὴν ἀποτελουμένην. ὥς τὴν μὲν πληγὴν τὴν ὑπὸ τοῦ ἀέρος, δι' ὧν εἴρηκεν ὀργάνων διαδιδόμενην εἰς τὴν ψυχὴν, εἶναι τὴν φωνήν, τὴν δ' ὑπ' αὐτῆς γινομένην κίνησιν τῆς αἰσθησεως εἶναι τὴν ἀκοήν. λοιπὸν δ' ὅση μὲν ταχεῖα τῆς πληγῆς, τουτέστι τῆς φωνῆς, εἶναι ταύτην ὀξεῖαν, ὅση δὲ βραδεῖα, βαρεῖαν. πολλῆς δὲ γενομένης τῆς φωνῆς εἶναι αὐτὴν μεγάλην, ὀλίγης δὲ μικράν, καὶ ὁμαλοῦς μὲν, λείαν, διασπάσματα δ' ἐχούσης, τραχεῖαν. σαφῶς οὖν ὁ Πλάτων ἐν τούτοις τὴν ταχεῖαν φωνὴν τίθεται ὀξεῖαν, καὶ τὴν βραδεῖαν βαρεῖαν· ἀλλ' οὐ τὴν ταχυτήτα αἰτίαν γίνεσθαι τῆς ὀξύτητος ἢ τὴν βραδυτήτα τῆς βαρύτητος, ὥστ' εἴπερ ἡ ταχυτῆς καὶ ἡ βραδυτῆς ποσότητες καὶ ἡ ὀξύτης καὶ ἡ βαρύτης κατὰ Πλάτωνα ποσότητες ἂν εἶεν.

Ἀριστοτέλης δ' ἐν τῷ δευτέρῳ Περὶ ψυχῆς περὶ τῆς

διαφορᾶς τῶν ψόφων ἀποδιδούς γράφει ταῦτα·

- (15) “Αἱ δὲ διαφοραὶ τῶν ψοφούντων ἐν τῷ κατ' ἐνέργειαν ψόφῳ δηλοῦνται· ὥσπερ γὰρ ἄνευ φωτός οὐχ ὁράται τὰ χρώματα, οὕτως οὐδ' ἄνευ ψόφου τὸ ὀξύ καὶ τὸ βαρύ· ταῦτα δὲ λέγεται κατὰ μεταφορὰν ἀπὸ τῶν ἀπτῶν· τὸ μὲν γὰρ ὀξύ κινεῖ τὴν αἴσθησιν ἐν ὀλίγῳ χρόνῳ ἐπὶ πολὺ, τὸ δὲ βαρὺ ἐν πολλῷ ἐπ' ὀλίγον. οὐ δὴ ταχύ τὸ ὀξύ, οὐδὲ βραδὺ τὸ βαρὺ, (20) ἀλλὰ γίνεται τοῦ μὲν διὰ τάχος ἡ κίνησις τοιαύτη, τοῦ δὲ διὰ βραδυτήτα, καὶ ἔοικεν ἔχειν ἀνάλογον τῷ περὶ τὴν ἀφὴν ὀξεῖ καὶ ἀμβλεῖ· τὸ μὲν γὰρ ὀξύ οἷον κεντεῖ, τὸ δ' ἀμβλύ οἷον ὠθεῖ διὰ τὸ κινεῖν, τὸ μὲν ἐν ὀλίγῳ, τὸ δ' ἐν πολλῷ, ὥστε συμβαίνει τὸ μὲν ταχύ, τὸ δὲ βραδὺ εἶναι.”

- (25) Σαφηνιστέον δὲ καὶ τὴν τούτου λέξιν. διαφορὰς γὰρ τοῦ ψόφου ἔφη τὴν ὀξύτητα καὶ τὴν βαρύτητα· διαφορὰ δὲ ψόφου τοῦ κατ' ἐνέργειαν οὐ τοῦ δυνάμει. ὁ μὲν γὰρ ἀτὴρ καθ' ἑαυτὸν δυνάμει ψόφος, ἀλλ' ἐκ τούτου οὔτε βαρέος ψόφου ἀντιληψόμεθα, οὐτ' ὀξέος, ἐκ μέντοι γε τοῦ ἤδη γινομένου ψόφου. γίνεται δὲ κατ' ἐνέργειαν ψόφος, ὅταν πληγῇ ὁ ἀτὴρ καὶ ὑπομείνῃ <μή> διαχυθεῖς· ἐν τῷ οὖν κατ' ἐνέργειαν ψόφῳ καὶ ἡ

2 τῆς πληγῆς Alexanderson τὴν πληγὴν codd. 7 ὁμαλῆς Tg 9-10 βραδεῖαν βαρεῖαν scripsi βαρεῖαν βραδεῖαν codd. 19 οὐδὲ βραδὺ τὸ βαρὺ] τὸ δὲ βαρὺ βραδὺ Ar. οὐδὲ τὸ βαρὺ βραδὺ cod. Ar. Vat. 266 20 διὰ τὸ τάχος Ar. 21 ἔχειν ἀνάλογον codd. et cod. Ar. Ambros. Ἦσο ἀνάλογον ἔχειν ceteri codd. Ar. 28 πληγεῖ M 29 <μή> addidi; cfr. 49.23-4, Ar. *De an.* 419b21-2

organs and induces in us a movement, and that this movement, the one produced by the impact which is transmitted to the soul, is hearing. So he means that the impact made by air, transmitted through the organs he has mentioned to the soul, is the voice, and the movement of sense-perception which arises through its agency | is hearing. [47D]

His remaining point is that any impact – that is, any impact of the voice – that is swift is high, and any that is slow is low. When there is a large amount of voice it is loud, and when the amount is small it is quiet; when it is even it is smooth, and when it contains gaps it is rough. In these statements, then, Plato clearly represents a swift voice as high and a low voice as slow, | and does not say that swiftness is the cause of high pitch or slowness of low pitch; so that since swiftness and slowness are quantities, high and low pitch must, according to Plato, be quantities too.

In the second book of the *De anima* Aristotle writes as follows about the difference between voices:

| The differences between things that make sounds are displayed in sound when it is actualised; for just as colours are not seen without light, so the high (sharp) and the low (heavy) are not perceived without sound. These things are said on the basis of a transference from tangible things, for the sharp moves the sense to a great extent in a short time, while the heavy moves it to a small extent in a long time. It is not the case that the high (sharp) is swift and the low (heavy) slow; | rather, the movement of the former acquires its quality¹⁶⁶ because of its speed, the latter because of its slowness. There seems to be an analogy with the sharp and the blunt in the field of touch; for the sharp pierces, as it were, while the blunt pushes, since the former produces movement in a short time and the latter in a long one, with the consequence that the one is swift and the other slow.¹⁶⁷

His statements too need to be clarified. He says that height and depth of pitch | are differences of sound, differences of a sound that is actualised, not of potential sound. For air in itself is potentially sound, but from it we receive no impression of a low sound or a high one; we do so only from a sound that has already come into being. An actual sound comes into being when the air is struck and stands firm <and is not> dispersed.¹⁶⁸ It is

¹⁶⁶ Aristotle does not use the Greek noun for 'quality' here; more literally what he says is that the former 'becomes such', *toiautē*. But if he is using the expression accurately, it unambiguously points to the category of quality rather than quantity.

¹⁶⁷ Aristotle *De anima* 420a–b.

¹⁶⁸ Porphyry is thinking of *De anima* 419b21–2, but he quotes it inaccurately. Aristotle wrote: 'This happens when air that has been struck stands firm and is not dispersed'; see 49.23–4 below, where it is quoted correctly. Porphyry's syntax is slightly different, and the words 'and is not' are missing from the text as printed by Düring.

- (30) ὀξεῖα καὶ ἡ βαρεῖα τοῦ ψόφου ἀπογέννησις. ὥσπερ γὰρ χωρὶς φωτός φησιν οὐ δύναται χρώμα τι ὁραθῆναι—δεῖ γὰρ φῶς περιεχύνσθαι τοῖς σώμασιν, ὅταν αὐτῶν παραδείξῃ χρώματα—οὕτως οὐδ' ἄνευ ψόφου τοῦ
- (48) κατ' ἐντελέχειαν καὶ ἤδη γινομένου τὸ ὀξύ ἐν τούτῳ καὶ τὸ βαρὺ γνωρισθήσεται. λέγεται δέ φησι ταῦτα ἐπὶ τῶν ψόφων, τουτέστι τὸ βαρὺ καὶ τὸ ὀξύ, ἀπὸ τῶν ἀπτῶν τῆς μεταφορᾶς γενομένης. ὥς γὰρ τὸ ὀξύ καθ' ἀφῆν ἐν ὀλίγῳ χρόνῳ [καὶ ἐπ' ὀλίγον] ἀψάμενον ἐπὶ πολὺ κινεῖ τὴν αἴσθησιν, διικνουμένης τῆς ὀξύτητος ταχέως καὶ δι' ὀλίγου εἰς τὴν αἴσθησιν, τὸ δ' ἄμβλύ ἐν πολλῷ τε χρόνῳ κινεῖ τὴν αἴσθησιν καὶ ἐπ' ὀλίγον διὰ τὸ μὴ διικνεῖσθαι ταχέως, μηδὲ διατέμνειν τὴν σάρκα τὸ ὀξύ ὥσπερ, ἀλλ' ὠθεῖν καὶ βραδέως ἐφικνεῖσθαι, οὕτω καὶ κατὰ τοὺς ψόφους ὁ ὀξύς κινεῖ τὴν αἴσθησιν ἐν ὀλίγῳ χρόνῳ ἐπὶ πολὺ, ὁ δὲ βαρὺς ἐν πολλῷ καὶ ἐπ' ὀλίγον. ταχυτῆς μὲν οὖν αἰτία ὀξύτητος καὶ ὀξύτης ταχυτῆτος καὶ βραδυτῆς βαρύτητος· οὐ μὴν ἡ ὀξύτης ἐστὶ ταχυτῆς, οὐδ' ἡ βαρύτης βραδυτῆς. ἀντιλέγων γὰρ Πλάτωνί φησιν· “οὐ δὴ ταχύ τὸ ὀξύ”, οὐδὲ τὸ βαρὺ τῆς φωνῆς γένος βραδύ—πρὸς γὰρ ἐκείνους ταῦτα ἀποτείνεται—ἀλλὰ τὸ μὲν ὀξύ γίνεται διὰ τὸ τάχος τῆς περὶ τὴν πληξιν φορᾶς, τὸ
- (15) δὲ βαρὺ διὰ τὴν βραδυτῆτα τῆς πληγῆς, ὥστ' ὀξεῖαν μὲν φωνὴν ἀποτελεῖσθαι τῆς περὶ τὸν ἄερα κινήσεως τάχιστα γινομένης, βαρεῖαν δὲ βραδείας, ἀνάλογόν τε ἔχει ἡ μὲν ὀξεῖα τῷ κατὰ τὴν ἀφῆν ὀξεῖ σώματι, ἡ δὲ βαρεῖα τῷ κατὰ τὴν ἀφῆν ἄμβλει. ὥς γὰρ τὸ μὲν ὀξύ κινεῖ τὴν αἴσθησιν ἐν ὀλίγῳ μὲν χρόνῳ, ἐπὶ πολὺ δέ· οὕτως ἡ ὀξεῖα φωνὴ διὰ
- (20) ταχυτῆτα τῆς πληγῆς γινομένης ἐπιπλέον διικνεῖται τῆς ἀκοῆς. ὥς δὲ τὸ ἄμβλύ κινεῖ μὲν τὴν αἴσθησιν ἐν πλείονι μὲν χρόνῳ, ἐπ' ὀλίγον δὲ διὰ τὸ ὠθεῖν μᾶλλον ἀλλὰ μὴ διατέμνειν· οὕτως ἡ βαρεῖα φωνὴ διὰ βραδυτῆτα τῆς πληγῆς τοῦ ἄερος γινομένης ἐπ' ὀλίγον τῆς ἀκοῆς διικνεῖται. ἐπὶ μὲν οὖν τῶν ἀπτῶν τὸ ὀξύ ταχύ καὶ τὸ ἄμβλύ βραδύ, ἐπὶ δὲ
- (25) τῶν ψόφων ἡ ταχυτῆς ὀξύτητος αἰτία τῶν ψόφων καὶ ἡ βραδυτῆς βαρύτητος. διαφέρει δ' ἡ περὶ τὸ αἴτιον καὶ τὸ ποιοῦν ἡγεῖσθαι τὸ συμβαῖνον

31 χρώμα τι] χρώματα g 32 σώμασιν m ὁμασιν ceteri quos secuti sunt Wallis et Düring αὐτῶν m αὐτόν g αὐτοῖς Wallis et Düring

1 βαρὺ m (in marg. M βραδύ m. pr.) βραδύ g 2 λέγεσθαι m 3 μεταφορᾶς] διαφορᾶς g
4 [καὶ ἐπ' ὀλίγον] delevi 5 διικνουμένης — 6 αἴσθησιν om. Mg 8 βραδέως] βαρέως M
ἀφικνεῖσθαι Tp 10 καὶ ὀξύτης ταχυτῆτος del. Alexanderson 13 βαρὺ... βραδύ Alexanderson
βραδύ... βαρὺ codd. 17 ἔχει Höeg 1934 ἔχειν codd. 25 ἡ ταχύτης — ψόφων om. g 26 ἡ Wifstrand ἡ codd.

therefore in the actualised sound that the | height and the depth of sound arise. For just as a colour cannot be seen without light, he says – for light must have flowed around the bodies whenever it reveals their colours – so without sound that is fully actualised and already existent the high and the low will not be recognised in it. He says that these things, height (sharpness) and depth (heaviness), are attributed to sounds by transference from tangible things. For what is sharp to the touch moves the sense a lot while striking in a short time, | since the sharpness penetrates to the sense quickly and in a short time, whereas what is blunt moves the sense a little in a long time, because it does not penetrate quickly and does not cut through the flesh as what is sharp does, but pushes and arrives slowly. In the same way, in the sphere of sounds, a high (sharp) sound moves the sense a lot in a short time and a low (heavy) sound moves it a little | in a long time.

[48D]

Thus swiftness is the cause of height (sharpness) and sharpness is the cause of swiftness, and slowness is the cause of depth (heaviness).¹⁶⁹ But sharpness is not swiftness, nor is heaviness slowness. Aristotle is contradicting Plato when he says ‘It is not the case that the high (sharp) is swift’, nor is the low (heavy) kind of voice slow – for it is against him that these remarks are directed – but high pitch arises because of the swiftness of the movement involved in the impact, | and low pitch because of the slowness of the impact, so that a high voice is produced when the air’s movement is very swift, and a low one when it is slow; the high (sharp) voice is analogous to a body that is sharp to the touch, and the low (heavy) voice to one that is blunt to the touch. For just as a sharp body moves the sense a lot in a short time, so a sharp voice, when | the impact is swift, penetrates the hearing more; and just as a blunt body moves the sense in a longer time, but only a little because it pushes and does not cut through, so a heavy voice, when the air’s impact occurs slowly, penetrates the hearing only a little.

Thus in the case of tangible things the sharp is swift and the blunt is slow, but in the case of | sounds swiftness is the cause of the sharpness (height) of sounds and slowness of heaviness (depth). There is a difference between thinking of an attribute as the cause and the agent and thinking of it as

¹⁶⁹ Alexanderson would delete ‘and sharpness is the cause of swiftness’, which does not appear in the edition of Wallis (1699). But while swiftness is the cause of sharpness in sounds, sharpness is the cause of swiftness in tangible objects; and in sounds slowness is the cause of heaviness. See 48.24–32 below. For completeness, Porphyry might have added here ‘and bluntness is the cause of slowness’ (in tangible objects); but this is not immediately relevant, and although Porphyry is addicted to balanced clauses and usually exploits every available contrast, it is unnecessary to alter or supplement the text.

- ἢ περὶ τὸ αἰτιατὸν καὶ τὸ πάσχον. καὶ ὁ Ἀριστοτέλης περὶ τὸ αἰτίον φησιν εἶναι τὸ συμβαῖνον καὶ διὰ τοῦτο ἐν μὲν τοῖς ψόφοις ἢ ταχυτῆς τῆς πληγῆς τοῦ ἀέρος, ὅς ἦν αἴτιος τοῦ ψόφου, ποιεῖ κατ' αὐτὸν τὴν ὀξύτητα. ἐν δὲ τοῖς ἀπτοῖς ἢ ὀξύτης ἢ περὶ τὸν σίδηρον φέρε, ὅς ἦν τὸ αἶτιον, ποιεῖ τὴν ταχυτῆτα καὶ ἐπὶ τῆς βαρύτητος καὶ ἐπὶ τῆς ἀμβλύτητος ὡσαύτως. ὁ δὲ Πλάτων περὶ τὸ αἰτιατόν, “ταχείας μὲν
- (30) γὰρ οὕσης τῆς φωνῆς ὀξεῖαν αὐτὴν γίνεσθαι, βραδείας δὲ βαρεῖαν.” εἰ δὲ κατὰ τὸν Πλάτωνα ὥς ποιεῖ τὸ ποιοῦν, οὕτω πάσχει τὸ πάσχον καὶ ἔμπαλιν, εἴη ἂν τὰ περὶ τὸ αἰτιατόν συμβαίνοντα προϋπάρχοντα ποιητικῶς ἐν τῷ αἰτίῳ, καὶ ταύτῃ ὁμόφωνοι εἶεν ἂν ἀλλήλοις οἱ φιλόσοφοι.
- (5) Τούτοις τοίνυν καὶ τοῖς Πυθαγορεῖοις ἐπόμενος ὁ Πτολεμαῖος ἐπὶ τὰς κατὰ τάχῃ καὶ τὰς βραδυτῆτας αἰτιολογίας μεταβέβηκε, τὴν πρόφασιν λαβὼν τῆς μεταβάσεως ἀπὸ τοῦ τὴν λεπτότητα αἰτίαν εἶναι ὀξύτητος ἀποδοῦναι καὶ τὴν παχύτητα βαρύτητος. καὶ γὰρ ἐν τοῖς ἀπτοῖς τὰ μὲν λεπτὰ εἶναι ὀξεῖα, τὰ δὲ παχέα ἀμβλέα· ὀξεῖα δὲ καὶ ἀμβλέα τῷ τὰ μὲν
- (10) πλήττειν ἄθροϋστερον, τὰ δὲ μὴ· ἄθροϋστερον δὲ πλήττει παρὰ τὸ θᾶττον διικνεῖσθαι. ὡσαύτως δὲ καὶ τῶν ἀπτῶν τὰ πυκνότερα <ὀξύτερα>, ὀξύτερα δὲ τῷ πλήττειν ἄθροϋστερον, ἄθροϋστερον δὲ παρὰ τὸ μάλλον πλήσσειν διικνεῖσθαι ἤπερ τὰ μανότερα. εἴληπται δὲ καὶ τὰ περὶ τοῦ κατὰ τὸν ἀέρα ἀθροῦ παρὰ τοῦ Ἀριστοτέλους. ἀπορῶν γάρ, πότερον ψοφεῖ τὸ
- (15) τυπτόμενον ἢ τὸ τύπτον ἢ καὶ ἄμφω, γράφει·
- “Πότερον δὲ ψοφεῖ τὸ τυπτόμενον ἢ τὸ τύπτον ἢ καὶ ἄμφω, τρόπον δ' ἕτερον; ἔστι γὰρ ὁ ψόφος ἢ κίνησις τοῦ δυναμένου κινεῖσθαι τὸν τρόπον τοῦτον ὃνπερ τὰ ἀλλόμενα ἀπὸ τῶν λείων, ἐπὶ τὰς κρούσεις. οὐ δὲ πᾶν, ὥσπερ εἴρηται, ψοφεῖ τυπτόμενον καὶ τύπτον, οἷον ἐὰν πατάξῃ βελόνη
- (20) βελόνην, ἀλλὰ δεῖ τὸ τυπτόμενον ὁμαλὸν εἶναι, ὥστε τὸν ἀέρα ἄθροϋν ἀφάλλεσθαι καὶ σεῖεσθαι.”

1 βαρεῖαν] βραδεῖαν T 4 σημειοῦται ὅτι ἀλλήλοις ὁμοφώνουσιν Ἀριστοτέλης καὶ Πλάτων add. in marg. M 11 <ὀξύτερα> add. Wifstrand 17 ἢ om. Ar. 18 ἀλλόμενα codd. et codd. Ar. Laur. 81/1, Vat. 266, Ambros. 450 σφαλλόμενα Vat. 1026 ἀφαλλόμενα ceteri codd. Ar. ἐπὶ τὰς κρούσεις p 21 ἀφείλεσθαι p

that which is caused and acted upon. Aristotle says that the attribute [i.e. swiftness] is the cause, and because of this the swiftness of the impact of the air, which was said to be the cause of the sound, produces | its sharpness. The sharpness in tangible things, on the other hand, in a piece of iron, for instance, which was said to be the cause, makes the swiftness; and the same goes for heaviness and bluntness. Plato, however, holds that the attribute is that which is caused: 'when the voice is swift it is high (sharp), and when it is slow it is low (heavy)'. But if, as Plato says, as the agent acts, so that which is affected is affected,¹⁷⁰ and conversely, the attributes arising in what is caused would pre-exist actively in the cause; and in this way the two philosophers would speak with one voice.¹⁷¹

[49D]

| Ptolemy, then, following these people and the Pythagoreans, has now moved on to a discussion of the causes of swiftness and slowness, taking the statement that thinness is a cause of sharpness (height) and thickness is a cause of depth (heaviness) as his occasion for the move. And indeed in tangible objects thin things are sharp and thick things are blunt, and they are sharp and blunt because the former | strike more compactly and the latter do not. In the same way those tangible things that are more dense are sharper; they are sharper because they strike more compactly; and they penetrate more compactly than more diffuse things because they strike more powerfully. Ptolemy has also taken from Aristotle what he says about the compactness of the air. For when Aristotle poses the problem whether what sounds is | the thing struck or the striker or both, he writes:

Is it the thing struck or the striker that makes a sound, or is it both but in different ways? For sound is a movement of that which is capable of being moved in the manner in which things rebound from smooth surfaces when one strikes them. Not everything struck makes a sound, and nor does every striker, as we were saying – for instance if a needle strikes | a needle – but what is struck must be even, so that the air rebounds and is shaken as a single mass.¹⁷²

¹⁷⁰ This is a reminiscence of Plato *Gorgias* 476d3–4.

¹⁷¹ This seems disingenuous, not only because Plato does not say 'and conversely', implying that every attribute produced by the cause must already exist in it, but also because in the passage under discussion, as Porphyry has interpreted it, Aristotle rejects both parts of Porphyry's contention; when a 'sharp' sound is produced, the sharpness does not pre-exist in the movement that causes it, and the movement's swiftness is not transferred to the sound. Cf. Introduction pp. 24–6.

¹⁷² Aristotle *De anima* 420a. The verb translated as 'is shaken' is *seisthai*, used for instance of earthquakes and of the shaking of the crest on a warrior's helmet. Aristotle may be trying to convey the notion of movement that is induced in a stationary or nearly stationary medium, something akin to 'vibration'; the same idea may be at work in the next quotation. But it is not clear that his remarks about the air's behaviour are always consistent with this position.

- Καὶ πάλιν· “οὐκ ἔστι δὲ ψόφου κύριος ὁ ἀήρ, ἀλλὰ δεῖ στερεῶν πληγὴν γίνεσθαι πρὸς ἄλληλα καὶ πρὸς τὸν ἀέρα· τοῦτο δὲ γίνεται, ὅταν
(25) πληγῇ, ψοφεῖ· δεῖ γὰρ φθάσαι τὴν κίνησιν τοῦ ραπίζοντος τὴν θρύψιν τοῦ ἀέρος, ὥσπερ εἰ σωρὸν ἢ συρφετὸν ἄμμου τύπτει τις φερόμενον ταχύ.”

- Λαβὼν δὴ ὁ Πτολεμαῖος, ὅτι τὰ λεπτότερα καὶ τὰ πυκνότερα ὀξύτερους ψόφους ἀποτελεῖ παρὰ τὸ θάττον καὶ μᾶλλον διηκνεῖσθαι δύνασθαι,
(30) ὑλῶν δεικνύς τὸ εἰρημένον. τί γὰρ φησι;

- (50) **καὶ διὰ τοῦτο χαλκὸς τε ξύλου ψόφον ὀξύτερον ποιεῖ καὶ χορδὴ λίνου, πυκνότερα γάρ [30]**

Ταῦτα μὲν ἐκ τῆς πυκνότητος τὴν αἰτίαν· ἐκ δὲ τῆς λεπτότητος ἐπάγει.

**τῶν τε ὁμοιοπύκνων καὶ ἴσων χαλκῶν ὁ λεπτότερος [30]
καὶ τῶν ὁμοιοπύκνων καὶ ἴσων χορδῶν ἡ ἰσχυρότερα καὶ τὰ κοῖλα τῶν
[8] ναστῶν**

- Τῆς πυκνότητος καὶ τοῦ μεγέθους τῶν αὐτῶν ὄντων τὸ λεπτότερον καὶ
(5) ὀξυφωνότερον· καὶ τὰ κοῖλα δ’ ὀξυφωνότερα τῶν ναστῶν διὰ τὴν λεπτότητα. καὶ ταῦτα τοίνυν τὴν αἰτιολογίαν εἴληφεν ἀπὸ τῆς λεπτότητος. ἐξ ἀμφοῖν δέ, τῆς πυκνότητος λέγω καὶ τῆς λεπτότητος, αἰτιολογῶν ἐπάγει.

καὶ πάλιν αὐτῶν ἀρτηριῶν αἱ πυκνότεραι καὶ λεπτότεραι ὀξυτονώτεραι.

- (10) Ἀλλὰ μέχρι μὲν τούτων ὁμολογούμενα τοῖς ἐναργέσι λέγει, τῇ πυκνότητι καὶ τῇ λεπτότητι ἀποδιδούς τὴν ὀξύτητα τῶν ψόφων. ἃ δ’ ἐξῆς ἐπάγει, δεῖται ἐπιστάσεως· λέγει γάρ.

τούτων δὲ ἕκαστον οὐ δι’ αὐτὸ τὸ πυκνὸν ἢ λεπτὸν κυρίως ἀλλὰ διὰ τὸ εὐτονον, ὅτι τοῖς μὲν τοιοῦτοις εὐτονωτέροις εἶναι συμβέ-

22. post ἀήρ add. οὐδὲ τὸ ὕδωρ Ar.
τύπτοι Ar. 29. μέρους m

23. γενέσθαι Ar.

26. συρφετὸν ἄμμου] ὄρμαθὸν ψάμμου Ar.

6. αἰτιολογίαν] ἀναλογίαν g

And again:

Air is not responsible for the sound,¹⁷³ but rather there must occur an impact of solid things against one another and against the air. This happens when air that has been struck stands firm and is not dispersed. Thus if it is struck vigorously and quickly | it makes a sound; for it is essential that the movement of the striker should forestall the fragmentation of the air, as when someone strikes a heap or a pile of sand which is in rapid motion.¹⁷⁴

Accepting, then, that thinner and denser things produce higher (sharper) sounds by being able to penetrate more quickly and powerfully, and that thicker and more diffuse things produce lower (heavier) sounds, Ptolemy goes on to demonstrate what has been said in the cases of | materials taken one at a time. What does he say?

And for this reason bronze makes a higher (sharper) sound than wood and gut-string than flax, since they are denser. Ptol. *Harm.* 7.29–30 [50D]

That is what he says about the cause grounded in denseness; about the cause grounded in thinness he adds:

Of pieces of bronze with the same density and equal length it is the finer that is sharper (higher) in tone, of strings with the same density and equal length it is the more slender, while hollow things are sharper toned than solids. Ptol. *Harm.* 7.30–8.1

When the density and size are the same the thinner is also | sharper voiced; and hollow things are sharper voiced than solids because of their thinness. This, then, is the causal account he derives from thinness. In giving a causal account drawing on both of them, by which I mean denseness and thinness, he adds:

And of windpipes, again, it is the denser and thinner that are sharper-toned. Ptol. *Harm.* 8.1–2

| Now up to this point he is saying things that agree with the evident facts, in attributing the sharpness (height) of sounds to denseness and thinness. But what he adds next demands close scrutiny. He says:

In each case this happens not through the density or thinness as such, but through high tension, since it is an attribute of things like this that they

¹⁷³ Aristotle says 'Neither air nor water is responsible . . .'; he has just made the point that we can hear in water as well as in air. 'Responsible' translates *kurios*.

¹⁷⁴ Aristotle *De anima* 419b. In the last line, where the Porphyry MSS have *sypheton*, 'pile', Aristotle has *hormathon*, which seems to refer – more appropriately – to a small sand-laden whirlwind of the kind usually called a 'dust-devil' or (in Australia) a willy-willy.

βηκεν, τὸ δὲ εὐτονώτερον ἐν ταῖς πληγαῖς γίνεται σφοδρότερον, τοῦτο δὲ ἀθρούτερον, τοῦτο δ' ὀξύτερον. [5]

- (14) Οὐ γὰρ πάντως τὸ λεπτόν εὐτονον· λεπταὶ γὰρ γίνονται φωναὶ καὶ
 (15) δι' ἀτονίαν, καὶ “ὅταν ὀλίγον ᾖ,” ὥς φησιν Ἀριστοτέλης, “τὸ πνεῦμα τὸ ἐκπῖπτον. διὸ καὶ τῶν παιδιῶν γίνονται <λεπταὶ> καὶ τῶν γυναικῶν καὶ τῶν εὐνούχων, ὁμοίως δὲ καὶ τῶν διαλελυμένων διὰ νόσον ἢ πόνον ἢ ἀτροφίαν· οὐ δύνανται γὰρ πολὺ τὸ πνεῦμα διὰ τὴν ἀσθένειαν ἐκπέμπειν. δηλὸν δ' ἐστὶ καὶ ἐπὶ τῶν χορδῶν· ἀπὸ γὰρ τῶν λεπτῶν καὶ τὰ φωνία
 (20) γίνεται λεπτά καὶ στενά καὶ τριχώδη, διὰ τὸ καὶ τοῦ ἀέρος τὴν πληγὴν γίνεσθαι κατὰ στενόν. οἷας γὰρ ἂν τὰς ἀρχὰς ἔχωσι τῆς κινήσεως αἱ τοῦ ἀέρος πληγαί, τοιαύτας καὶ τὰς φωνὰς συμβαίνει γίνεσθαι προσπιπτούσας πρὸς τὴν ἀκοήν, οἷον ἀραιὰς ἢ πυκνάς ἢ μαλακάς ἢ σκληράς ἢ λεπτὰς ἢ παχείας. αἱ γὰρ ὁ ἕτερος ἀήρ τὸν ἕτερον κινῶν ὡσαύτως ποιεῖ τὴν
 (25) φωνὴν ἅπασαν ὁμοίαν, καθάπερ ἔχει καὶ ἐπὶ τῆς ὀξύτητος καὶ ἐπὶ τῆς βαρύτητος. καὶ γὰρ τὰ τάχη τὰ τῆς πληγῆς τὰ ἕτερα τοῖς ἑτέροις συνακολουθοῦντα διαφυλάττει τὰς φωνὰς ταῖς ἀρχαῖς ὁμοίως.”
- (51) Ταῦτα εἶρηκεν ὁ Ἀριστοτέλης ἐν τῷ Περὶ ἀκουστών,
 οὐ καὶ πᾶν τὸ σύγγραμμα ἀναγκαιότατον ὑπάρχον παρὰ τὰ ἐνεστηκότα ὕστερον παραθήσομεν.
- Πλὴν ἀλλὰ φανερόν, ὅτι ἡ μὲν λεπτότης ποιεῖ τὴν ὀξύτητα καὶ εἰ
 (5) βούλεται τις, λεγέτω διὰ τὴν ταχυτῆτα· ταχεῖα γὰρ ἡ λεπτότης, οὐ μέντοι διὰ τὴν εὐτονίαν. τὸ μὲν γὰρ πυκνότερον ἔστω εὐτονώτερον, τὸ δὲ λεπτότερον οὐ πάντως εὐτονώτερον. ἐπειδὴ καὶ τὸ ἀθρούτερον τοῦ ἀέρος σφοδρότερον μὲν εἶναι δύναται, οὐ μέντοι τὸ σφοδρὸν καὶ ὀξὺ πάντως, ὥς καὶ αὐτῷ ἀρέσκει τῷ Πτολεμαίῳ ἐν ταῖς παρὰ τὴν βίαν τοῦ
 (10) πλήττοντος διαφοραῖς, τὸ μὲν σφοδρότερον παραδεξαμένῳ, τούτῳ δ' οὐχ ἔπεσθαι φαμένῳ τὸ ὀξύ, ἀλλὰ μᾶλλον τὸ μεῖζον. πῶς οὖν ἐνταῦθα ἀκολούθως ἐπήγαγεν, ὅτι τὸ εὐτονώτερον ἐν ταῖς πληγαῖς γίνεται σφοδρότερον, τοῦτο δ' ἀθρούτερον, τοῦτο δ' ὀξύτερον; τοῦ δ' αὐτοῦ παροράματος ἐχόμενος ἐπάγει τάδε.

16 <λεπταὶ> add. Düring

17 ἢ ἀτροφίαν om. g

20 διὰ] διό g

25 ἐπι^{sec} del. Bekker

26 τάχη] πάχη ss. πάθη T

2 ὑπάρχον] ὑπάρχειν Düring

10 τούτῳ Alexanderson τούτου codd.

are more highly tensioned; what is more highly tensioned is more vigorous in its impacts; this is more closely compacted; and this is sharper.¹⁷⁵ Ptol. *Harm.* 8.2–5

But what is thin is not invariably highly tensioned, for thin voices also arise | through lack of tension, and occur, as Aristotle says,

when the breath expelled is small in quantity. That is why the voices of children are thin, and those of women and eunuchs, and in the same way those of people enfeebled by illness or labour or lack of food, since because of their weakness they cannot emit much breath. It is clear too in the case of strings; for the sounds from thin strings | are thin and narrow and hair-like, because the impact of the air also occurs on a narrow front. Thus whatever character may belong to the sources of the movement of the impacts of air, the sounds that fall on the hearing will be of the same kind, diffuse or dense, for instance, or soft or hard or thin or thick. For as each portion of air moves the next in the same way, it makes the | whole sound alike, as is the case also with height and depth. For the speeds of impact, each succeeding closely on another, ensure that the sounds remain similar in character to their sources.¹⁷⁶

That is what Aristotle says in his *On Things Heard*; his whole treatise is of the greatest relevance to the present issues, and we shall append it later.¹⁷⁷ [51D] But it is at any rate clear that thinness causes high pitch (sharpness); and if | you like, let us say that it does so because of swiftness, since thinness is swift. But it is not because of high tension. For let it be the case that what is denser is more highly tensioned; but what is thinner is not necessarily highly tensioned. Again, a more compact body of air can be more vigorous, but the vigorous is not invariably also high pitched, as Ptolemy himself agrees when he accepts the more vigorous among the | differences in the force of the striker, but says that what follows from it is not high pitch but greater volume. How then has he logically inferred that the more highly tensioned among impacts is more vigorous, that this is more compact, and that this is sharper (higher pitched)? He persists in this mistake when he adds the following:

¹⁷⁵ That is, the more vigorous is more closely compacted, and what is more closely compacted is sharper.

¹⁷⁶ [Aristotle] *De audib.* 803b, quoted in its context at 74.33–75.13 below, where I add some notes.

¹⁷⁷ See 67.15–77.18 below. It is generally agreed that this treatise is not in fact by Aristotle, though it is certainly a product of the Peripatetic tradition; nor is it by Theophrastus, as some scholars have suggested. The likeliest candidate is Strato, who became head of the Lyceum on Theophrastus' death. See especially Gottschalk (1968).

διό κἄν ἄλλως τι ἢ εὐτονώτερον, [5]

οἷον ὡς σκληρότερον ἢ ὡς ὅλως μείζον, ὀξύτερον ποιεῖ ψόφον, κρατούσης ἐφ' ὧν ἀμφοτέρων ὑπάρχει τι τοῦ ὁμοίου ποιητικόν τῆς κατὰ τὸν ἕτερον λόγον ὑπεροχῆς, ὡς ὅταν ὁ χαλκὸς τοῦ μολίβδου ποιῇ ψόφον ὀξύτερον, ἐπειδὴ μᾶλλον ἐστὶν αὐτοῦ σκληρότερος ἢ οὗτος ἐκείνου ἐστὶ πυκνότερος. καὶ πάλιν ὁ μείζων εἰ τύχοι καὶ παχύτερος χαλκὸς τοῦ ἐλάττο- [10] νος καὶ λεπτοτέρου ποιεῖ ψόφον ὀξύτερον, ὅταν ὁ κατὰ μέγεθος λόγος μείζων ἢ τοῦ κατὰ τὸ πάχος.

- (16) Ὁ χαλκὸς ὀξύτερον ψόφον τοῦ μολίβδου ἀποτελεῖ, διότι πυκνότερος ἦν. ἔκειτο δὲ τὰ πυκνότερα ὀξυφωνότερα τῶν μανωτέρων, ἐπηκολούθει δὲ τὸ σκληρότερον τῷ πυκνότερῳ καὶ τὸ μαλακὸν τῷ μανωτέρῳ. ἡ αἰτία οὖν τοῦ ὀξέος διὰ τὸ πυκνόν, οὐ διὰ τὸ σκληρόν, ἐπεὶ ἐνδέχεται τὸ σκληρότερον καὶ μὴ ὀξυφωνότερον εἶναι· ὡς ἄνδρες παίδων σκληρότεροι καὶ βαρυφωνότεροι καὶ γυναῖκες ἀνδρῶν μαλακώτεροι καὶ ὀξυφωνότεραι· τοῦτο δὲ διὰ τὸ λεπτοτέρας ἔχειν τὰς ἀρτηρίας· ἔκειτο δὲ τὸ λεπτότερον ὀξυφθογγον. ὁ δὲ μείζων καὶ παχύτερος χαλκὸς τοῦ ἐλάττονος καὶ λεπτοτέρου σφοδροτέραν μὲν καὶ μείζονα ἤχην ἀποδίδωσιν, ὀξυτέραν δ' (25) οὐ. ἔκειτο δὲ καὶ ταῦτόν, ἄλλο εἶναι τὸ σφοδρὸν καὶ μείζον, ἄλλο τὸ ὀξύ. καὶ οὐ τοῦτο λέγω, ὅτι οὐκ ἔστιν ὅπου τὸ εὐτονώτερόν ἐστιν ὀξυφωνότερον—βοῦς γοῦν ἄρρην θηλείας ὀξύτερον μυκάται διὰ τὸ εὐτονώτερον τῆς ἀρτηρίας—ἀλλ' ὅτι τὰ εἰρημένα παραδείγματα τοῖς ὑπ' αὐτοῦ τεθεῖσιν οὐ πάνυ τι συνωνά φαίνεται· ὅλως δὲ μείζον ἔφη, ὅταν δύο ὦσι (30) χαλκοί, ὧν ὁ ἕτερος καὶ μείζων καὶ παχύτερος, ὁ δὲ καὶ ἐλάττων καὶ (52) λεπτότερος· ὅλως γὰρ μείζων ὁ ἕτερος, ὅτι καὶ κατ' ὄγκον ὑπόκειται μείζων καὶ κατὰ μέγεθος. καὶ οὐκ ἔστι τις λειπομένη σύγκρισις, καθ' ἣν ἰσοῦται αὐτῷ ὁ ἕτερος. ἐξῆς δι' ὑπογραφῆς τὸν ψόφον ἐπάγει.

τάσις γὰρ τίς ἐστὶ συνεχῆς τοῦ ἀέρος ὁ

ψόφος, ἀπὸ τοῦ τοῖς τὰς πληγὰς ποιοῦσιν ἐμπεριλαμβανομένου διήκουσα πρὸς τὸν ἐκτός, καὶ διὰ τοῦτο, καθ' οἷαν ἂν δύναμιν εὐτονώτερον ἕκαστον

16 ὁ om. g 18 πυκνότερῳ — τῷ om. G in cod. M erasum est 24 μείζονα T ὀξυτέραν ceteri 29 ὅλως Alexanderson ὅλον codd.

in lemma: 8.5 κἄν ἄλλως τι ἢ] καὶ ἄλλως τι εἴη ME 9 ἐστὶ om. ME 10 μείζων Alexanderson μείζον Düring 11 ante μέγεθος add. τὸ MEp

3 αὐτῷ] αὐτό p

| Hence if a thing is more highly tensioned in some other way, for instance by being harder to a greater degree than it is larger overall, it makes a higher sound, since where there exists in both of two things something that has the same effect, victory goes to the excess of the one ratio over the other – as when bronze makes a higher sound than lead, since it is harder than lead in a greater degree than lead is denser than it. And again, any larger and thicker piece of bronze makes a higher sound than the smaller and thinner, whenever the ratio in respect of magnitude is greater than that in respect of thickness.¹⁷⁸ Ptol. *Harm.* 8.5–12

Bronze produces a higher sound than lead because it is denser, as has been said. It was posited that denser things are sharper voiced than more diffuse things, and that being harder follows upon being denser and being soft follows upon being more diffuse. Then the cause of sharpness (high pitch) is the dense, not the hard, since it is possible for what is harder | not to be also sharper voiced. Thus men are harder and heavier voiced than boys, and women are softer and sharper voiced than men; this is because they have thinner windpipes, and it was posited that what is thinner is sharp noted. Further, a larger and thicker piece of bronze makes a more vigorous and louder sound [*ēcheē*], but not a sharper (higher) one than a thinner piece. | This too was posited, that what is more vigorous and louder is distinct from what is high pitched. I do not mean that there is no case in which what is more highly tensioned is sharper voiced – thus a bull's lowing is sharper than a cow's because of the greater tension of its windpipe¹⁷⁹ – but that the examples given by Ptolemy are evidently not in unison with things that he has posited. And he is speaking of something that is larger overall, when there are two | pieces of bronze of which one is both larger and thicker and the other is both smaller and thinner. For the former is large overall, since it is postulated that it is larger both in volume and in magnitude; and there is no remaining point of comparison in respect of which the other is equal to it.¹⁸⁰ He now goes on to sketch in outline what a sound is.

[52D]

For sound is a sort of continuous tensing of the air, penetrating to the outer air from the air immediately surrounding the things that make the impacts, and for this reason, to whatever degree each of the things making

¹⁷⁸ Ptolemy seems to be thinking of a flat sheet of bronze, or perhaps a disc; 'larger' and 'magnitude' must refer to the surface area of its faces.

¹⁷⁹ Cf. Aristotle *De gen. an.* 787b.

¹⁸⁰ Porphyry's point is that in order to assign responsibility for the difference in the pitches to differences in some particular dimension or dimensions of the objects that produce them, one would have to stipulate that their other dimensions were equal. Since there are no dimensions relevant to the objects' sizes other than their surface areas and thicknesses, which ex hypothesi are unequal, the comparison must be treating their overall sizes as responsible for the difference in pitch.

ἡ τῶν δι' ὧν αἱ πληγαί, θάττων τε καὶ ὀξύτερος ἀποτελεῖται. [15]

- (5) Ὁ ἄηρ ἠνωμένος ὧν ἐν αὐτῷ τὰ τε τὰς πληγὰς ποιοῦντα περιέχει καὶ ἀπὸ τῶν μείξεων τούτων συνεχῆς ἐστὶ παντὶ τῷ ἐκτὸς αὐτῶν διὰ τὸ ἠνωσθαι. ὅταν οὖν τὰ σώματα ἀλλήλοις συμπίπτοντα καὶ τοῦτον συναράξῃ, καὶ μὴ φθάσας διαχυθῇ, ἀλλὰ τὰς πληγὰς ὑπομείνῃ, διατείνεται ὑπὸ τῆς βίας τῆς πληγῆς ἄχρι πολλοῦ διικνουμένης ταύτης ἀπὸ τοῦ
- (10) ἐμπεριλαμβανομένου ἀέρος τοῖς τὰς πληγὰς ἐμποιοῦσι σώμασι πρὸς τὸν ἐκτὸς ἀέρα. διὸ καὶ οὐ μόνον παρόντες ἀντιλαμβάνονται τοῦ ψόφου, ἀν μὴ ὥσι τὰς ἀκοὰς βεβλαμμένοι, ἀλλὰ καὶ οἱ ποσὸν τι τούτων ἀφεστῶτες, καὶ ἄχρις ἂν οὗ διικνηται ἡ τάσις ἄθρυπτος μένουσα, ἀποτελεῖται καὶ διαμένει ὁ ψόφος, ἐπὶ τινων δὲ καὶ ἀντανακλᾶται.
- (15) “Ἦχώ γάρ,” φησὶν ὁ Ἀριστοτέλης, “γίνεται, ὅταν ἀπὸ τοῦ ἀέρος ἐνὸς γενομένου διὰ τὸ ἀγγεῖον τὸ διορίσαν καὶ κωλύσαν θρυφθῇ πάλιν ὁ ἄηρ ἀπωσθῇ ὥσπερ σφαῖρα.”

διὰ τε [15]

δὴ τούτων ἔοικεν ἢ κατὰ τὸ ὀξύ καὶ βαρὺ τῶν ψόφων διαφορά ποσότητος εἶδος εἶναι τι,

- (19) Διὰ τούτων φησὶ τῶν συστάσεων, δηλονότι τῶν κατὰ τὸ πυκνὸν καὶ
- (20) τὸ μακρὸν καὶ λεπτὸν καὶ παχύ, εὐτονόν τε καὶ ἄτονον, ἃ ἔχεται ποσότητος, δι' ὧν ἀπετελεῖτο ἡ ὀξύτης καὶ ἡ βαρύτης τῶν ψόφων, ἀποδείκνυται ποσότητος εἶναι διαφορά ἡ ὀξύτης καὶ ἡ βαρύτης καὶ οὐ ποιότητος. ἐπεδείξαμεν δ' ἡμεῖς, πῶς τοῦτο οὐκ ἐξ ἀνάγκης ἔπεται παραδέξασθαι διὰ τὸ ἐπὶ ποσότητι μὲν τῆς οὐσίας συνίστασθαι τὰς εἰρημένους διαφορὰς
- (25) τὰς κατὰ τὴν λεπτότητα καὶ πυκνότητα καὶ εἰ βούλει εὐτονίαν, τὴν τε παχύτητα καὶ μακρότητα καὶ ἄτονίαν· ταῦτα δ' εἶναι ποιότητος κατ' αὐτόν, καθ' ὅς συνίστασθαι τῶν ψόφων τὰς ὀξύτητας καὶ τὰς βαρύτητας οὔτε ποσῶν αἰτίων ὄντων προσεχῶς τοῦ τε ὀξέος καὶ βαρέος ἀλλὰ ποιῶν,
- (53) οὐτ' εἰ προσεχῶς τὸ ποσὸν ἦν αἴτιον τῆς τῶν ψόφων τοιαύτης διαφοράς ἐξ ἀνάγκης καὶ τοῦ αἰτιατοῦ ποσοῦ εἶναι ὀφείλοντος. τούτοις μὲν οὖν καὶ ἀκριβέστερον αὐτὸς ἐπιστήσεις.

5 τὰ τε τὰς πληγὰς ποιοῦντα περιέχει Alexanderson τοὺς τε τὰς πληγὰς ποιοῦντας παρέχει codd. 8 ante μὴ addendum <ὁ ἄηρ> conī. Düring τὰς πληγὰς Düring τῶν πληγῶν codd. 9 διικνουμένου MEV¹⁸⁷ g 11 καὶ om. g 12 τι om. m 13 οὐ] οὐ typographico errore Düring τάσις] στάσις Mg 14 μένει G 15 γίνεσθαι g 19 φησὶ] δὴ T 23 τοῦτο] τοῦτου g 25 εὐτονίαν] ἄτονίαν g

in lemmate^{prim.}: 8.15 θάττων M θάττων ss. ω E ἐλάττων Düring ὀξύτερος ss. ν E

the impacts is more highly tensioned, the sound is swifter and higher to the same degree. Ptol. *Harm.* 8.12–15

| The air, which is unified, embraces in itself the things that make impacts; and because it is unified it is continuous, from these meeting-points, with everything outside them. Then whenever bodies strike against one another and simultaneously disturb the air, and the air does not slip out of the way and become dispersed but stands fast under the impacts, it is put into a state of tension by the force of the impact, which reaches to a great distance out into the external air | from the air which is caught between the bodies that make the impacts. This is why it is not only those close by who perceive the sound, unless their hearing has been impaired, but also those placed at some distance from them; and up to the point to which the tension extends while remaining unbroken, the sound is produced and persists, and in some cases is also reflected back. | ‘For echo arises,’ says Aristotle, ‘when from air that has been unified by the vessel that contains it and prevents it from being scattered, the air bounces back again like a ball.’¹⁸¹

For these reasons it seems that difference of sounds in respect of height and depth is a form of quantity . . . Ptol. *Harm.* 8.15–17

He says that through these constitutions – plainly meaning those to do with denseness and | diffuseness, thinness and thickness and high and low tension – which are connected with quantity and through which the height and depth of sounds are produced, height and depth are shown to be differences of quantity and not of quality. But we have shown how accepting this does not necessarily follow, just because the differences mentioned are based in the quantity of substance, that is, | differences to do on the one hand with thinness and denseness, and with high tension too, if you like, and on the other hand with thickness and diffuseness and low tension. We have shown that on Ptolemy’s account these are qualities, through which the height and depth of sounds arise, and that neither if the causes of height and depth are strictly speaking not quantities but qualities, nor if quantity were strictly speaking the cause of this difference in sounds, must that which is caused necessarily be a quantity. You will certainly give even closer attention to these matters yourself.¹⁸²

[53D]

¹⁸¹ Aristotle *De anima* 419b.

¹⁸² This second-person singular comment is presumably directed to the unknown Eudoxius addressed at the outset. It may indicate that Porphyry envisages readers who will be interested in subtle philosophical distinctions, and perhaps that he expects them to be principally concerned with them, rather than with the technicalities of harmonic science. See Introduction Section 7.

- Λειπομένης δ' αἰτίας ἔτι πληγῶν διαφορᾶς τῆς παρὰ τὴν ἀπόστασιν
- (5) τοῦ πληττομένου πρὸς τὴν ἀρχὴν τῆς κινήσεως περὶ ταύτης λείπεται ποιήσασθαι λόγον. εἰσὶ γὰρ ἀποδοθεῖσαι αὐτῷ αἰτίαι τῶν διαφορῶν πληγῶν ἥτε παρὰ τὴν τοῦ πλήττοντος βίαν καὶ ἢ παρὰ τὰς σωματικὰς συστάσεις τοῦ τε πληττομένου καὶ τοῦ δι' οὗ ἡ πληγὴ, διπλοῦν δὲ τὸ πληττόμενον· καὶ γὰρ ὁ ἄῃρ, οὗ τὰς διαφορὰς συστάσεις παραιτεῖται,
- (10) ὡς πρὸς διαφορὰν πληγῶν ἀνεπιτηδεῖους καὶ τὸ τῷ πλήττοντι σώματι πρὸς τὸ πλήττεσθαι ὑποκείμενον. τρίτη δ' ἦν αἰτία ἢ παρὰ τὴν ἀποχὴν τοῦ πληττομένου πρὸς τὴν ἀρχὴν τῆς κινήσεως, ὣν ἡ μὲν παρὰ τὴν βίαν ἄσχιτος ἦν ἐκβεβλημένη τε, ὡς μηδὲν συντελοῦσα πρὸς τὴν ὀξύτητα καὶ βαρύτητα τῶν ψόφων. ἡ δὲ παρὰ τὰς σωματικὰς συστάσεις τοῦ
- (15) πληττομένου διηρεῖτο εἰς τε τὰς τοῦ ἀέρος διαφορὰς—ἦν γὰρ καὶ οὗτος τῶν πληττομένων—καὶ εἰς τὰς τῶν στερεῶν ἢ ἄλλων σωμάτων διαφορὰς, ὣν πάλιν τοῦ ἀέρος παρεθέντος αἱ σωματικαὶ συστάσεις τοῦ τε πλήττοντος καὶ τοῦ πληττομένου. πλήττοντος δ'—οὐχ ὡς ἡ βία ἡμῶν πλήττει· αὕτη γὰρ ἐκβέβληται· ἀλλ' ὡς δι' οὗ πληττομεν σώματος—
- (20) διηροῦντο εἰς τε τὰς πυκνώσεις καὶ μανώσεις, λεπτότητάς τε καὶ παχύτητας, λειότητάς τε καὶ τραχύτητας, τοὺς τε σχηματισμούς, ὣν οἶόν τε σχηματίζεσθαι, προσετίθετο δὲ καὶ ἡ εὐτονία καὶ ἡ ἀτονία· ὣν ἐν μόναις ταῖς μανότησι καὶ πυκνώσεσι, λεπτότησι καὶ παχύτησιν, εὐτονίαις τε καὶ ἀτονίαις αἰτία τῆς ὀξύτητος τῶν ψόφων καὶ βαρύτητος, ἐν
- (25) ταῖς ἄλλαις συστάσεσιν οὐκέτι. ἐπιστησάντων ἡμῶν περὶ τῆς κατὰ τὴν εὐτονίαν καὶ ἀτονίαν παραλήψεως, ἦν ὕστερον προστέθεικε, πῶς ταύτην μὲν αἰτίαν τίθεται ὀξύτητος καὶ βαρύτητος· τὴν δὲ παρὰ τὴν βίαν ἢ ἀσθένειαν παρητεῖτο διαφορὰν, ὡς σφοδροτέρους μὲν ἢ ἀσθενεστέρους ποιοῦσαν τοὺς ψόφους, ὀξυτέρους δὲ καὶ βαρυτέρους οὐκέτι· τῷ σφο-
- (30) δρῷ ἐκεῖ μὲν ῥηθέντος μὴ ἔπεσθαι τοῦ ὀξέος· ἐπὶ δὲ τοῦ εὐτόνου ὕστερον τῷ σφοδρῷ ἀποδοθέντος ἔπεσθαι τοῦ ὀξέος.

Τούτων οὖν θεωρημένων περὶ τῆς λοιπῆς αἰτίας τῆς κατὰ τὴν διάστασιν τῶν τυπόντων τε καὶ τυπτομένων ποιούμενος τὸν λόγον συντόμως ἐπάγει τὰς κατασκευάς, διὰ τὸ μάλιστα ταύτην πεπατηθῆσαι παρὰ τοῖς

- (54) πρὸ αὐτοῦ καὶ διαβεβληθῆσαι παρὰ πᾶσιν, ὡς φθάσαντες καὶ ἡμεῖς κατ' ἀρχὰς τοῦ λόγου παρεστήσαμεν θέντες τὰ εἰωθότα λέγεσθαι τοῖς ἄλλοις περὶ τούτου.

5 λείπεται] λέγεται T 8 συστάσεις] αἰσθήσεις ss. συστάσεις M 15 ἦν — 16 διαφορὰς om. T 17 παρεθέντος mut. in παραιτηθέντος T 19 ἐκβέβλητο g 21 οἶόν τε] οἶονται p 22 καὶ ἡ ἀτονία om. G 31 ante τῷ add. τό p

Since the remaining cause of difference between impacts is the one corresponding to the distance between | that which is struck and the origin of the movement, that is the topic we still have to discuss. For Ptolemy has mentioned as causes of differences between sounds the one connected with the force of the striker and the one connected with the bodily constitutions of that which is struck and that by which the impact is made. That which is struck is of two sorts: there is the air, whose different constitutions are passed over | as irrelevant to the difference between impacts, and there is the body that is subject to the impacts of the body that strikes. The third cause was said to be that connected with the distance between the thing struck and the origin of the movement. Of these causes, the one connected with force was not divided into kinds, and has been rejected as contributing nothing to the height and depth of sounds. The one connected with the bodily constitutions was divided, so far as the | thing struck is concerned, into differences in the air – for air too was said to be one of the things struck – and differences in the solids or other bodies, whose bodily constitutions, again with the air set aside, are those of the striker and the thing struck. Those of the striker – not conceived as the force with which we strike, since that has been rejected, but as the body by means of which we strike – are divided into denseness and diffuseness, thinness and thickness, | smoothness and roughness, and the shapings of the things that are capable of being shaped; and high and low tension were also added to the list. But the cause of height and depth in sounds lies only, among these forms of constitution, in their diffusenesses and densenesses, thinnesses and thicknesses and high and low tensions, | and not in the others. We have scrutinised the use he makes of high and low tension, which he added later, and the way in which he represents it as a cause of height and depth. He rejects the cause connected with force or weakness, on the grounds that it makes sounds more vigorous or weaker but not higher or lower; and | in that context he denies that high pitch follows upon vigour. Later, however, in connection with high tension, he asserts that high pitch does follow upon vigour.

When he has considered these causes, then, and gives a discussion of the remaining cause, the one corresponding to the distance between the strikers and the things struck, he sets out the reasoning briefly, because this is ground very well trodden by his predecessors and has been traversed by everyone, as we too mentioned in advance, at the beginning of our discussion, when we set out the things that others have regularly said about this matter.

[54D]

καὶ μᾶλλον ἐκ τῆς τῶν ἀποχῶν τοῦ τε πληττομένου καὶ τοῦ πλήττοντος ἀνισότητος. τῷ γὰρ ποσῷ τούτων ἐναργέστατα συνίσταται, ταῖς μὲν ἐλάττοσι διαστάσεσιν ἐπομένης τῆς ὀξύτητος διὰ τὸ ἐκ τῆς ἐγγύτητος σφοδρόν, ταῖς δὲ μείζοσι τῆς βαρύτητος διὰ τὴν παρὰ [20] τὸ ἀπώτερον ἔκλυσιν, ὥστε ἀντιπεπονηθῆναι ταῖς διαστάσεσι τοὺς ψόφους. γίνεται γὰρ ὡς ἡ μείζων ἀποχὴ τῆς ἀρχῆς πρὸς τὴν ἐλάττονα, ὁ ἀπὸ τῆς ἐλάττονος ψόφος πρὸς τὸν ἀπὸ τῆς μείζονος, καθάπερ ἐπὶ τῶν ῥοπῶν ὡς ἡ μείζων ἀποχὴ τοῦ ἀρτήματος πρὸς τὴν ἐλάττονα, ἡ ἀπὸ τῆς ἐλάττονος ῥοπὴ πρὸς τὴν ἀπὸ τῆς μείζονος. καὶ τοῦτο δὲ ὅτι ἐναργές, πρό- [25] χειρον ἀπὸ τῶν διὰ τινος μήκους γινομένων ψόφων, ὡς τῶν χορδῶν καὶ τῶν αὐλῶν καὶ τῶν ἀρτηριῶν· ὀξύτεροι γὰρ γίνονται πάντως, τῶν ἄλλων [9] διαμενόντων τῶν αὐτῶν, ἐπὶ τε τῶν χορδῶν οἱ κατὰ ἐλάττους διαστάσεις τῶν ὑπαγωγέων λαμβανόμενοι τῶν κατὰ μείζους, κάπὶ τῶν αὐλῶν οἱ διὰ τῶν ἐγγυτέρω τοῦ ὑφολμίου, τουτέστι τοῦ πλήττοντος, τρυπημάτων ἐκπίπτοντες τῶν διὰ τῶν ἀπωτέρω, κάπὶ τῶν ἀρτηριῶν οἱ τὴν ἀρχὴν τῆς πληγῆς ἔχοντες ἀνωτέρω καὶ σύνεγγυς τοῦ πληττομένου τῶν ἀπὸ [6] τοῦ βᾶθους.

- (6) Ἐπὶ τῶν διαστάσεων τῶν ἐγγύς τε καὶ πόρρω οἱ πλείους οὐ τὴν σφοδρότητα ῥητίσαντο καὶ τὴν ἔκλυσιν, ὡσὰν τῆς μὲν ὀλίγης διαστάσεως διὰ τὸ ὀλίγον σφοδροτέραν τὴν πληγὴν ἀπεργαζομένης καὶ διὰ τοῦτο ὀξύτεραν, τῆς δὲ πολλῆς ἔκλυτον καὶ διὰ τοῦτο βαρυτέραν. ἔμπαλιν γὰρ (10) πολλὰ τοῦ πόρρωθεν ἐπιδεῖται περὶ τὸ σφοδρόν, ὡσὰν ἐκ τοῦ ἐγγύθεν τῆς δυνάμεως ἐγκοπτόμενα. τὰ γοῦν ὀξυβελῆ καὶ πάντα τὰ τῇ ἀφέσει ἐνεργοῦντα δεῖται τοῦ πόρρωθεν περὶ τὴν δύναμιν, καὶ τοῦτο Ἀριστοτέλης ἐπισημαίνεται, ὡς μετ' ὀλίγον ἐπιδείξομεν. τίνα οὖν οἱ πλείους αἰτίαν ἀποδεδώκασιν τοῦ τὴν μὲν πόρρωθεν πληγὴν βαρυτέραν, τὴν δ' (15) ἐγγύθεν γίνεσθαι ὀξύτεραν; τὴν βραδυτῆτά φημι καὶ τὴν ταχυτῆτα. ἐπὶ τε γὰρ τῶν χορδῶν τῶν ὁμοίων τὰς μικροτέρας ὀξύτερον ἀποτελεῖν τὸν φθόγον, τὰς δὲ μακροτέρας βαρυτέρον διὰ τὸ βραδεῖαν ἐπὶ τῶν μακροτέρων γίνεσθαι τὴν ἀντίστασιν καὶ ὁμοίως βραδυτέραν τὴν μετὰ τὴν πληγὴν ἀποκατάστασιν, ὅθεν βραδυτέρον πληττόμενον τὸν ἀέρα βαρύν

7 διαστάσεως] διαθέσεως T

12 καὶ τοῦ Ἀριστοτέλους g

18 καί —

19 ἀποκατάστασιν om.

g

in lemmate: 8.18 συνίστανται MEp

22 ὁ — 24 ἐλάττονα om. M

27 πάντως] πάντων M

... and it arises more particularly from inequality in the distances between the striker and the thing struck.¹⁸³ For it is in the quantity of these that they [sc. high and low pitch] are most clearly constituted, high pitch following upon the smaller distances because of the vigour arising from proximity, low pitch upon the greater because of the slackening that goes with being further away, so that the sounds are modified in the opposite way to the distances. For as the greater distance from the origin is to the smaller, so is the sound from the smaller distance to that from the greater, just as with weights, as the greater distance of the weight [from the fulcrum] is to the lesser, so is the downward thrust from the lesser distance to that from the greater.¹⁸⁴ That this is true is obvious from sounds that come about as the consequence of some length, like those of strings and *auloi* and windpipes; for so long as other factors remain the same, in strings those produced with smaller distances between the bridges are invariably higher than those produced with greater ones, in *auloi* those coming out through the holes nearer the *hypholmion*¹⁸⁵ – that is, nearer to the striker – are higher than those coming through the holes that are further away, and in windpipes those in which the source of the impact is further up and near the thing struck are higher than those coming from the | depths. Ptol. *Harm.* 8.17–9.6

In connection with nearby and faraway distances, most people did not represent vigour and slackness as causes on the basis that the small distance produced a more vigorous impact because of its smallness, and therefore a higher one, while the great distance produced a slack and therefore a lower-pitched impact. For on the contrary, | many things need to come from a substantial distance in order to gain vigour, as they are deprived of power when they come from nearby.¹⁸⁶ Thus sharp missiles and all things that act by being thrown need substantial distance to gain power, and Aristotle indicates this, as we shall show shortly. What cause, then, have most people assigned to the fact that an impact from far away is lower pitched and one | from nearby is higher? I say that it is slowness and swiftness. For in the case of similar strings the shorter strings make the note higher and the longer make it lower, because in longer strings the displacement is slow, and the recoil after the impact, similarly, is slower, so that the air is struck more

¹⁸³ This is the remainder of the sentence quoted in the previous lemma.

¹⁸⁴ That is, if the weights on the beam of the balance are at different distances from the fulcrum, they will be perfectly balanced only if the weight ('downward thrust') set at the greater distance is smaller than the weight at the smaller distance; and the ratio of the greater distance to the smaller will be the same as the ratio of the weight at the smaller distance to the one at the greater.

¹⁸⁵ The *hypholmion* is the section of the *aulos* immediately above the main pipe in which the finger-holes were drilled, and immediately below the section into which the reed mouthpiece was inserted.

¹⁸⁶ Porphyry is not objecting to the allusion to distance, but to the specification of vigour and lack of vigour as the causes of differences in pitch. The most important theorist in whose treatment vigour is one of the main causes of pitch-difference is Archytas; see 56.21–57.23 below.

- (20) ἀποτελεῖν τὸν φθόγγον· ἐπὶ δὲ τῶν βραχυτέρων ταχείας τῆς τε πληξέως τῆς τε ἀποκαταστάσεως γινομένης ὅξυν γίνεσθαι τὸν ψόφον. ἐπὶ τε τῶν αὐλῶν τὰ ἐγγυτάτω τῆς γλωσσίδος τρυπήματα ὀξύτερον ἀποδιδόναι τὸν ψόφον, ἅτε ταχύτερον τοῦ πνεύματος δι' αὐτῶν εἰς τὸν ἐκτὸς ἀέρα ἐκπίπτοντος· διὰ μέντοι τῶν πόρρω τρημάτων βαρύτερον τὸν ψόφον ἀποδίδοσθαι, διὰ δὲ τῶν κατωτάτω βαρύτερον τῷ βραδείαν διὰ τούτων τὴν διέξοδον γίνεσθαι τοῦ πνεύματος.

- Ἐπὶ τε τῶν ἀρτηριῶν, ὅταν μὲν τὸ πληττον πνεῦμα, ὃ προῖέμεθα, ἄνωθεν ἐκπέμπηται καὶ ἐγγύς ῃ τοῦ τε πληττομένου ἀέρος καὶ τῆς ἀπαντώσης τῷ πνεύματι γλώσσης, ὅξυν τὸν ψόφον ἀποτελεῖσθαι διὰ τὸ
- (30) ἐγγύθεν· ὅταν δὲ κάτωθεν καὶ ἐκ βάθους, βαρύν, τῷ πόρρω εἶναι τὸ
- (55) πληττόμενον τοῦ πληττοντος, καὶ διὰ τοῦτο βραδείαν γίνεσθαι τὴν κίνησιν. ἀντιπεπόνθασιν οὖν αἱ διαστάσεις τοῖς ψόφοις, ὥς ἐπὶ τῶν ζυγῶν αἱ ῥοπαὶ ταῖς ἀπὸ τοῦ ἀρτήματος ἀποστάσεσιν· ἡ μὲν γὰρ μείζων ἀποχὴ τοῦ ἀρτήματος ἐλάττονα ποιεῖ τὴν ῥοπήν, ἡ δ' ἐλάττων μείζονα. ἐπὶ
- (5) δὲ τῶν ψόφων ἡ πλείων ἀπόστασις τοῦ τῆς πληγῆς κατάρχοντος βαρύτερον ποιεῖ τὸν ψόφον, ἡ δ' ἐλάττων ὀξύτερον. διὸ οὖν λόγον ἔχει ἡ μείζων ἀποχὴ τῆς πληγῆς πρὸς τὴν ἐλάττονα, τοῦτον ἔχει τὸν λόγον ὁ ἀπὸ τῆς ἐλάττονος ἀποχῆς ψόφος πρὸς τὸν ἀπὸ τῆς μείζονος· ὥς ἐπὶ τῶν ῥοπῶν ὥς ἡ μείζων ἀποχὴ τοῦ ἀρτήματος πρὸς τὴν ἐλάττονα, ἡ
- (10) ἀπὸ τῆς ἐλάττονος ῥοπῆς πρὸς τὴν ἀπὸ τῆς μείζονος. δεῖ δ' ἐπὶ τῶν ὁμοίων χορδῶν ἀκούειν τῶν λεγομένων, εἰ δὲ μή, ἐναντίον τι συμβήσεται· ἡ γὰρ αὕτη ἐκβληθεῖσα καὶ διὰ τοῦτο μείζων γενομένη ὀξύτερον φθέγγεται καὶ οὐ βαρύτερον· αἴτιον δὲ τὸ λεπτότερον αὐτὴν γίνεσθαι διὰ τὴν τάσιν.

**αὐλῷ γὰρ τινι φυσικῷ καὶ τὸ περὶ τὰς ἀρτηρίας ὅμοιον,
ἐνὶ τούτῳ μόνῳ παραλλάττον, ὅτι διὰ μὲν τῶν αὐλῶν, τοῦ κατὰ τὸ πληττον
τόπου μένοντος, ὁ τοῦ πληττομένου παραχωρεῖ πρὸς τὸν ἐγγύτερον ἢ**

24 τρυπημάτων g 27 προσιέμεθα mp

3 ἀποστάσεσιν Alexanderson ἀπόστασιν codd. ἀπόστασιν — 4 ἀρτήματος om. g
12 ἐκβληθεῖσα] ἐκλυθεῖσα Mg

slowly and | produces a low note; but in shorter strings the impact and the recoil are swift and the sound is high. In *auloi* too, the holes drilled nearest to the mouthpiece give out a higher sound because the breath travels out more swiftly through them into the external air; whereas a lower sound is given out through the more distant holes | and the lowest sound through the lowest holes, because the escape of the breath out through these holes is slow.¹⁸⁷

In the case of windpipes, when the breath which we emit and which makes the impact is sent out from high up, close to the air that is struck and to the tongue which meets the breath, it makes the sound high pitched because it comes from | nearby; and when it is sent out from low down, from the depths, it makes the sound low pitched, because the thing struck is far away from the striker, and for that reason the movement is slow. Thus the distances have the opposite attributes to the sounds, just as on the balance the weights have the opposite attributes to the distances from the fulcrum. For the greater distance from the fulcrum makes the downward thrust smaller and the smaller distance makes it greater.¹⁸⁸ In the case | of sounds, the greater distance from the origin of the impact makes the sound lower and the smaller makes it higher. Thus the ratio of the greater distance <from the origin> of the impact to the smaller distance is the same as the ratio of the sound from the smaller distance to the sound from the greater, just as in the case of weights, as the greater distance from the fulcrum is to the smaller, so is | the downward thrust from the smaller distance to that from the greater. What has been said must be understood as referring to similar strings; otherwise the result will be the opposite. For when the same string is stretched and for that reason becomes longer, it gives a higher, not a lower sound. The cause is its becoming thinner because of the tension.

[55D]

| For the windpipe is like a sort of natural *aulos*, differing only in this one respect, that in *auloi* the location of the striker remains constant while that of the thing struck moves closer to or further away from the striker through

¹⁸⁷ Porphyry is probably right in saying that this is the sort of explanation that 'most people' have given. But it seems clear that he is drawing directly on the passage of Aelianus quoted at 33.16–36.3 above, and in particular on 33.28–35.12. In saying that breath emerging through holes nearer the mouthpiece gives higher sounds because it 'travels out more swiftly', neither author means merely that it takes a shorter time for it to meet the outer air; they mean that it travels at a higher speed.

¹⁸⁸ Porphyry is thinking of the situation in which the two ends of the beam are perfectly balanced. If the weights on either side are attached at different distances from the fulcrum, the one that is further away must exert less downward thrust (that is, it must weigh less) than the other. Cf. n. 184 above.

ἀπώτερον τοῦ πλήττοντος ἐκ τῆς ἐπιτεχνήσεως τῶν τρυπημάτων, ἐπὶ δὲ τῶν ἀρτηριῶν ἀνάπαλιν, τοῦ κατὰ τὸ πληττόμενον τόπου μένοντος, ὁ [10] τοῦ πλήττοντος παραχωρεῖ πρὸς τὸν ἐγγύτερον ἢ ἀπώτερον τοῦ πληττομένου, τῶν ἐν ἡμῖν ἡγεμονικῶν τῇ συμφύτῳ μουσικῇ θαυμασίως ἅμα καὶ προχείρως εὐρίσκοντων τε καὶ λαμβανόντων, ὑπαγωγέως τρόπον, τοὺς ἐπὶ τῆς ἀρτηρίας τόπους, ἀφ' ὧν αἱ πρὸς τὸν ἐκτὸς ἀέρα διαστάσεις ἀνάλογον ἑαυτῶν ταῖς ὑπεροχαῖς ἀποτελοῦσι τὰς τῶν ψόφων διαφοράς. [15]

- (16) Τὸ πληττόν ἐστιν ἐπὶ τε τῶν αὐλῶν καὶ ἐπὶ τῶν ἀρτηριῶν ἡ ὁρμή καὶ τὸ πνεῦμα ὃ καθ' ὁρμὴν προΐεμεν, τὸ πληττόμενον δ', ἐφ' ὧν μὲν ὁ αὐλός, ἐφ' ὧν δ' ἡ ἀρτηρία. ἀλλ' ἐπὶ μὲν τῶν αὐλῶν τὸ μὲν πληττόν πνεῦμα καὶ ἡ καταρχὴ τῆς ἀπὸ τῶν αὐλούντων πληγῆς μένει ἡ αὐτή·
- (20) παραχωρεῖ δ' ὁ αὐλός διὰ τῆς ἐπιτεχνήσεως τῶν τρυπημάτων ἢ ἐγγύς τῆς ἀρχῆς γινομένης τοῦ πλήττοντος ἢ πόρρω καὶ οὕτω διαφόρους ἀποδιδούσης τοὺς ψόφους. ἐπὶ τε τῶν ἀρτηριῶν ἡ μὲν πληττομένη ἀρτηρία μένει, τὸ δὲ πληττόν, ὅπερ ἦν τὸ καθ' ὁρμὴν πνεῦμα, τοὺς ἐπὶ τῆς ἀρτηρίας τόπους εὐρίσκει φυσικῶς καὶ τούτοις παραχωρεῖ ὑπαγωγέως τρόπον·
- (25) ἀφ' ὧν αἱ παρὰ τὸν ἐκτὸς ἀέρα ἐκπίπτουσιν διαστάσεις ἀνάλογον ταῖς ἑαυτῶν ὑπεροχαῖς ἀποτελοῦσι τὰς τῶν ψόφων διαφοράς.

17 προσίεμεν g 21 ἀποδιδούσης Alexanderson ἀποδιδούσα codd. 25 ἐκπίπτουσι m
in lemmate: 9.7 ἐν[ι] ἐν ΜΕρ διὰ] ἐπὶ ΜΕρ 8 πρὸς] παρὰ ΜΕρ 11 πρὸς] παρὰ ΜΕρ

the device of the finger-holes, whereas in windpipes it is the other way round, the location of the thing struck remaining constant while that of the striker moves closer to or further away from the thing struck, as our ruling principles, with their inborn music, find and grasp marvellously and easily, in the manner of a bridge, the places on the windpipe from which the distances to the outer air will produce differences in sounds in proportion to the amounts by which the distances exceed one another. Ptol. *Harm.* 9.6–15

In *auloi* and windpipes the striker is the impulse and the breath which we project with the impulse; and that which is struck is in the former case the *aulos* and in the latter the windpipe.¹⁸⁹ But in *auloi* the breath that strikes and the origin of the impact made by the players remain unchanged, | while the *aulos* changes position¹⁹⁰ through the device of the finger-holes, so that the origin – that which strikes – becomes nearer or further away, and thus makes the sounds different. In windpipes the windpipe that is struck remains unchanged, but that which strikes, which was said to be the breath dispatched by the impulse, finds naturally the places on the windpipe, and changes position between them in the manner of a bridge.¹⁹¹ | The

¹⁸⁹ This is a strange remark, and the rest of the paragraph adds further difficulties; Porphyry's account may or may not be consistent with itself and with Ptolemy, but it is in any case very awkwardly expressed. In Ptolemy's version what is struck is in both cases the outer air (as Porphyry also implies at 54.21–55.2, and perhaps again in the last sentence of the present paragraph, 55.25–6); and in vocalisation, the point at which the breath strikes the windpipe and rebounds from it counts – for the purpose of determining the sound's pitch – as the origin of the breath's movement, not as the point at which it strikes another body and produces a sound.

¹⁹⁰ There are two problems here. First, the verb *parachōrei*, translated 'changes position', is always intransitive, and it seems strange to make the *aulos* its subject; what changes its position is not the *aulos* but the point at which the breath strikes the outer air. Secondly, this translation of the verb does not correspond very closely to its regular sense, 'to retreat', 'to give way', which seems inappropriate to the context either here or in the verb's reappearance at 55.24. We might perhaps think of the breath as striking the *aulos* when it meets the edge of a finger-hole, and of the point at which the breath strikes the *aulos* as 'retreating' or 'receding' as it moves to finger-holes further from the mouthpiece. But in the next clause Porphyry represents *parachōrein* as including movements in either direction, making the origin either nearer to the point struck or further away.

¹⁹¹ The bridge referred to here is the movable bridge on a monochord, which is shifted along under the string to determine different sounding-lengths and hence different pitches (see I.8 below). It is possible, with some difficulty, to construe this sentence consistently with what Ptolemy says, i.e. that the 'thing struck' (the outer air) stays in the same place, while the sound's pitch depends on the distance between it and the point at which the breath rebounds from the windpipe. We can do so if we refrain from interpreting the reference to 'the windpipe that is struck' as identifying the counterpart of the outer air in Ptolemy's theory. The windpipe is not the 'thing struck' in the relevant sense, and the phrase 'that is struck' (by the impulse of breath) is merely descriptive. As in Ptolemy, it is the various points at which the windpipe is struck that count as the origins of the relevant movement; the breath 'finds' and strikes the windpipe at these points and then sets off again from them over longer or shorter distances to the outer air. As the next sentence says, it is these distances that determine the sound's pitch. I am grateful to Stefan Hagel for helping me with this problem and others in the passage.

Τὰ μὲν δὴ τοῦ Πτολεμαίου περὶ τῆς κατὰ τοὺς ψόφους δξύτητος καὶ βαρύτητος τοιαῦτα, τὰ μὲν παρ' αὐτοῦ ἐπινοηθέντα, τὰ δὲ καὶ παρὰ τῶν πρὸ αὐτοῦ εἰλημμένα.

- (30) Δεῖ δὲ καὶ ἡμᾶς, καθάπερ ἐπηγγέλμεθα, ἐπιστῆσαι τῷ ζητήματι, εἰ καὶ ἐν πολλοῖς μέρεσι τῆς ἐξηγήσεως τὴν ἑαυτῶν φθάσαντες ἦδη γνώμην ἀπεδείξαμεν. ὅτι μὲν τοίνυν ἡ τῆς τοιαύτης αἰτίας ἀπόδοσις παλαιὰ
- (56) τις ἦν καὶ παρὰ τοῖς Πυθαγορείοις κυκλουμένη, καὶ διὰ τῶν ἔμπροσθεν μὲν ἀπεδείξαμεν. παρακείμεθω δὲ καὶ νῦν τὰ Ἀρχύτα τοῦ Πυθαγορείου, οὗ μάλιστα καὶ γνήσια λέγεται εἶναι τὰ συγγράμματα. λέγει δ' ἐν τῷ Περὶ μαθηματικῆς εὐθύς ἐναρχόμενος τοῦ λόγου τάδε·
- (5) “Καλῶς μοι δοκοῦντι τοῖ περὶ τὰ μαθήματα διαγνώμεν καὶ οὐθὲν ἄτοπον ὀρθῶς αὐτοὺς περὶ ἐκάστου θεωρεῖν. περὶ γὰρ τὰς τῶν ὅλων φύσις καλῶς διαγνόντες ἔμελλον καὶ περὶ τῶν κατὰ μέρος, οἷά ἐντι, ὀψεσθαι. περὶ τε δὴ τὰς τῶν ἄστρον ταχυτάτος καὶ ἐπιτολᾶν καὶ δυσίων παρέδωκαν ἡμῖν διάγνωσιν καὶ περὶ γεμετρίας καὶ ἀριθμῶν καὶ οὐχ
- (10) ἥκιστα περὶ μουσικᾶς. ταῦτα γὰρ τὰ μαθήματα δοκοῦντι εἶμεν ἀδελφεά. πρᾶτον μὲν οὖν ἐσκέψαντο, ὅτι οὐ δυνατόν ἐστιν εἶμεν ψόφον μὴ γεννηθείσας πληγὰς τινων ποτ' ἄλλαλα. πλαγὰν δ' ἔφαν γίνεσθαι, ὅκκα τὰ φερόμενα ἀπαντιάσαντα ἀλλήλοις συμπτῇ. τὰ μὲν οὖν ἀντίαν φορὰν φερόμενα ἀπαντιάζοντα αὐτὰ αὐτοῖς συγκαλᾶντα, τὰ δ' ὁμοίως φερόμενα, μὴ ἴσῳ δὲ τάχει, περικαταλαμβανόμενα παρὰ τῶν ἐπιφερομένων τυπτόμενα ποιεῖν ψόφον. πολλοὺς μὲν δὴ αὐτῶν οὐκ εἶναι ἀμῶν τᾶ φύσει οἴους τε γινώσκεσθαι, τοὺς μὲν διὰ τὰν ἀσθενείαν τὰς πλῆγας, τοὺς δὲ διὰ τὸ μάκος τὰς ἀφ' ἀμῶν ἀποστάσιος, τινὰς δὲ καὶ διὰ τὰν ὑπερβολὰν τοῦ μεγέθους. οὐ γὰρ παραδύεσθαι ἐς τὰν ἀκοάν ἡμῖν τῶς
- (15) μεγάλως τῶν ψόφων, ὥσπερ οὐδ' ἐς τὰ σύστομα τῶν τευχέων, ὅκκα πολὺ τις ἐκχέη, οὐδὲν ἐγχεῖται. τὰ μὲν οὖν ποτιπίπτοντα ποτὶ τὰν
- (20) αἰσθασιν, ἃ μὲν ἀπὸ τὰν πλαγᾶν ταχὺ παραγίνεται καὶ <ἰσχυρῶς>, ὁξέα φαίνεται· τὰ δὲ βραδέως καὶ ἀσθενέως, βαρέα δοκοῦντι ἤμεν. αἱ
- (57)

5 τοῖ] τό g διαγνόμεν Blass διαγνῶναι Porph. διαγνώμεναι Nicom. *Arithm.* I.3.3 6 post αὐτοὺς add. οἷά ἐντι Nicom. ἔκαστον p ἐκάστων Blass θεωρεῖν] φρονεῖν Nicom. φρονέν Blass et Huffman 6–7 τὰς ... φύσεις g 8 ante ὀψεσθαι add. καλῶς Nicom. ὀψεῖσθαι Nicom. 8 περὶ –10 μουσικᾶς] περὶ τε δὴ τὰς γεωμετρικᾶς καὶ ἀριθμητικᾶς καὶ σφαιρικᾶς παρέδωκαν ἡμῖν σαφῇ διάγνωσιν, οὐχ ἥκιστα δὲ καὶ περὶ μωσικᾶς Nicom. δύσιων m 10 εἶμεν] ἤμεν Düring ἔμεναι Nicom. post ἀδελφεά add. περὶ γὰρ ἀδελφεὰ τὰ τῷ ὄντος πρῶτιστα δύο εἶδεα τὰν ἀναστροφῶν ἔχει Nicom. 11 εἶμεν codd. ἤμεν Düring 13 ἀπαντιάζοντα in marg. m. a. T ἀπαντ' ἄξαντα codd. 14 συγκαλᾶντα, τὰ Diels συγκαλᾶν, τὰ codd. 15 παρὰ Stephanus περὶ codd. 16 εἶναι Stephanus e Porph. 81.7 ἔστιν codd. 18 μήκος V⁸⁷g 20 οὐδ' ἐς Blass οὐδέ codd. σύστημα p 21 ἐκχέη ... ἐγχεῖται Huffman e codd. m Porph. 81.11 ἐγχεῖη ... ἐγχεῖται codd.

1 αἰσθασιν T αἰσθησιν ceteri <ἰσχυρῶς> add. Blass 2 ἀσθενέως Huffman ἀσθενῶς codd. βαρέα] βραδέα Mg

distances leading out to the external air produce differences in the sounds in proportion to their own excesses.¹⁹²

These, then, are the things that Ptolemy says about the height and depth of sounds, some of which he has thought of himself, while others have been taken from his predecessors. | But we too must give close attention to the enquiry, as we announced earlier, even though in many parts of our exposition we have revealed our opinion in advance. We have already shown that the specification of this kind of cause is ancient and was in circulation among the Pythagoreans; but let us now set out what is said by the Pythagorean Archytas,¹⁹³ whose writings are said to be definitely and genuinely his. This is what he says right at the beginning of his work *On Mathematics*.¹⁹⁴

[56D]

| Those concerned with the sciences seem to me to have excellent discernment, and it is not strange that they understand particular things correctly. For having exercised good discrimination about the nature of wholes, they were likely also to get a good view of the way things really are taken part by part. They have handed down to us a clear understanding of the speed of the stars and their risings and settings, of geometry, of numbers, and not | least of music. For these sciences seem to be sisters.¹⁹⁵

They noticed first that there can be no sound unless there has been an impact of things upon one another. They said that an impact occurs when things in motion meet one another and collide. Those travelling in opposite directions and meeting make a sound as each slows down the other, while those travelling in the same direction | but at different speeds make a sound when overtaken and struck by those rushing after them. Many of these sounds are not capable of being discerned by our nature, some because of the weakness of the impact, some because of the extent of the distance from us, and some even because of their excessive magnitude. For large sounds do not slip | into the ear, just as nothing flows into the narrow neck of a vessel when one pours out a large quantity.

Now when things strike against our organ of perception, those that come swiftly and powerfully from the impacts appear high pitched, while those that come slowly and weakly seem low. Thus if someone moves a stick

[57D]

¹⁹² On the term 'excess', *hyperochē*, see n. 62 above. ¹⁹³ Cf. 139.13 with n. 642.

¹⁹⁴ The passage quoted is printed as Fragment 1 both in DK and in Huffman (2005); the opening paragraph is also quoted, with slight but significant variations, at Nicom. *Intr. Arith.* 1.3. Nicomachus gives the title of the work as *Harmonics*, which may be a good pointer to its general character. For all the relevant texts, translations and detailed commentary see Huffman (2005): 103–61. In his preface (xiii) he comments that he found several errors in Düring's readings of the principal MSS, and in revising the *apparatus criticus* I have drawn heavily on his.

¹⁹⁵ Cf. Plato *Rep.* 530d. Here Nicomachus adds: 'since their concern is with the two primary forms of what is, which are sisters themselves.' DK print this as a genuine part of the passage; Huffman (2005): 121–4 gives cogent reasons for thinking it a comment added by Nicomachus himself.

- γάρ τις ῥάβδον λαβὼν κινοῖ νωθρῶς καὶ ἀσθενέως, τᾷ πλαγᾷ βαρύν ποιήσει τὸν ψόφον· αἱ δὲ κα ταχύ τε καὶ ἰσχυρῶς, ὁξύν. οὐ μόνον δὲ
- (5) κα τούτῳ γινοίημεν, ἀλλὰ καὶ ὅκκα ἀμέσ ἢ λέγοντες ἢ ἀείδον-
τες χρήζομες τι μέγα φθέγγασθαι καὶ ὁξύ, σφοδρῶ τῷ πνεύματι φθεγ-
γόμενοι. ἔτι δὲ καὶ τοῦτο συμβαίνει ὥσπερ ἐπὶ βελῶν· τὰ μὲν ἰσχυρῶς ἀφιέμενα πρόσω φέρεται, τὰ δ' ἀσθενέως ἐγγύς. τοῖς γὰρ ἰσχυρῶς φερο-
μένοις μᾶλλον ὑπακούει ὁ ἄηρ, τοῖς δ' ἀσθενέως ἦσσαν. τωὐτό δὲ καὶ
- (10) ταῖς φωναῖς συμβήσεται· τᾷ μὲν ὑπὸ τῷ ἰσχυρῷ τῷ πνεύματος φερο-
μένα μεγάλη τε ἦμεν καὶ ὀξέα, τᾷ δ' ὑπ' ἀσθενέος μικρὰ τε καὶ βαρέα.
ἀλλὰ μὲν καὶ τούτῳ γὰ κα ἴδοιμες ἰσχυροτάτῳ σαμείῳ, ὅτι τῷ αὐτῷ
φθεγξαμένῳ μέγα μὲν πόρσωθέν κ' ἀκούσαιμες μικρὸν δ' οὐδ' ἐγγύ-
θεν. ἀλλὰ μὲν καὶ ἔν γα τοῖς αὐλοῖς τὸ ἐκ τῷ στόματος φερόμενον
- (15) πνεῦμα ἐς μὲν τὰ ἐγγύς τῷ στόματος τρυπήματα ἐμπήπτον διὰ τὰν ἰσχύν
τὰν σφοδρὰν ὁξύτερον ἄχον ἀφήσιν, ἐς δὲ τὰ πόρσω βαρύτερον, ὥστε
δηλον ὅτι ἅ ταχεῖα κίνασις ὁξύν ποιεῖ, ἅ δὲ βραδεῖα βαρύν τὸν ἄχον.
ἀλλὰ μὲν καὶ τοῖς ῥόμβοις τοῖς ἐν ταῖς τελεταῖς κινουμένοις τὸ αὐτὸ
συμβαίνει· ἡσυχᾷ μὲν κινούμενοι βαρύν ἀφίεντι ἄχον, ἰσχυρῶς δ' ὁξύν.
- (20) ἀλλὰ μὲν καὶ ὁ γὰ κάλαμος αἶ κά τις αὐτῷ τὸ κάτω μέρος ἀποφράζας
ἐμφυσῇ, ἀφήσει <βαρέαν> τινα ἀμῖν φωνάν· αἱ δὲ κα ἐς τὸ ἡμισυ ἢ
ὀπόστον μέρος αὐτῷ, ὁξύ φθεγξέεται. τὸ γὰρ αὐτὸ πνεῦμα διὰ μὲν τῷ
μακρῷ τόπῳ ἀσθενὲς δφέρεται, διὰ δὲ τῷ μείονος σφοδρόν.”
- Εἰπὼν δὲ καὶ ἄλλα περὶ τοῦ διαστηματικῆν εἶναι τὴν τῆς φωνῆς κίνη-
(25) σιν συγκεφαλαιοῦται τὸν λόγον ὥς
- “Ὅτι μὲν δὴ τοῖ ὀξεῖς φθόγγοι τάχιον κινέονται, οἱ δὲ βαρεῖς βράδιον,
φανερὸν ἀμῖν ἐκ πολλῶν γέγονεν.”
- (58) Διὰ μὲν δὴ τούτων καὶ τῶν ἔτι πρόσθεν παρακειμένων, ὅτι Πυθαγό-
ρειος καὶ παλαιὰ τις δόξα ἦν αὕτη, ἥς προύστη ὁ Πτολεμαῖος, τὰ μὲν

3 κοινοὶ ὡθρῶς p καὶ] τε καὶ Düring 5 κα τούτῳ Blass κατὰ τοῦτο codd. κα τούτῳ
<τοῦτο> Düring ἀμέσ Blass ἀμέσ MTE ἀμέ V¹⁸⁷ ἀμέσ G et Düring 6 τι Blass ei codd.
6-7 φθεγγόμενοι. ἔτι δὲ καὶ] φθεγγόμεθα· αἶ τι δὲ <κα μικρὸν καὶ βαρὺ, ἀσθενεῖ> καὶ conl. Blass,
post φθεγγόμενοι lacunam indicavit Diels 9 τωὐτό Blass τοῦτο codd. 11 ὀξέα... βαρεῖα
T ὀξέα... βαρεῖα ceteri μικρᾷ] μικρᾷ g 12 γὰ om. p κα ἴδοιμες Blass κατεῖδοιμες codd.
ἰσχυροτάτῳ Blass ἰσχυρῷ τόπῳ codd. σαμείῳ Blass σαμείῳ codd. 13 μικρὸν g 15 ἐς Wal-
lis ὡς codd. 17 κίνησις MTE ποιοῖ ME 20 ὁ γὰ V¹⁸⁷ ὅσα TE ὅτου ἅ ceteri αἶ κά τις GT
ἐκατὶς MEV¹⁸⁷ αὐτῷ codd. αὐτῷ Düring 21 <βαρέαν> add. Mullach κα Düring καὶ codd.
22 ὀπόστον] ἀπόστον p αὐτῷ αὐτῷ Düring 23 φέρεται] ἐκφέρεται Düring μείονος] μείζονος
G

sluggishly and weakly he will make a low-pitched sound with the impact, but a high one if he moves it swiftly and strongly. We can grasp this not only | from this example, but also <from what happens> when we want to utter something loud and high pitched, either in speaking or in singing, since we utter it with a violent breath. The following also happens, as it does with missiles: the ones that are thrown strongly travel to a distance, while those thrown weakly fall nearby. For the air yields more to those travelling strongly, and less to those travelling weakly. The same thing | will happen with voices too: those travelling under the agency of a strong breath are loud and high pitched, while those travelling under the agency of a weak breath are quiet and low pitched. Here is the most powerful evidence in which we may see this: we can hear a person shouting loudly from far away, but when the same man speaks quietly we cannot hear him even from nearby.

In *auloi*, too, if the breath travelling from the mouth | goes into the finger-holes near the mouth it emits a higher sound [*āchos* = *ēchos*] because of its vigorous force, but a lower one if it goes into the holes that are further away. Hence it is clear that a swift movement makes a sound [*āchos*] high, while a slow one makes it low. The same thing happens, once again, with the *rhomboi* that are whirled about in the mystery-cults: moved gently they give out a low-pitched sound [*āchos*], moved powerfully a high one.¹⁹⁶ | Similarly, again, with the *kalamos*: if one blocks its lower end and blows into it, it will give out a low-pitched voice, but if one blows into its half-length or any other part of it, it will utter a high pitch.¹⁹⁷ For if the breath travels through a long passage it comes out weakly, but if the same breath travels through a shorter passage it comes out more vigorously.

After saying other things too, about the voice's movement being intervallic,¹⁹⁸ | he rounds off the discussion as follows: 'Thus the fact that high notes move more swiftly and low ones more slowly has become clear to us through many pieces of evidence.'

Through these statements and ones set out even earlier, we have given sufficient proof that it was an ancient Pythagorean doctrine that Ptolemy

[58D]

¹⁹⁶ *Rhomboi* ('bull-roarers') are flat pieces of wood or other material whirled on a string to make a pulsating buzz; they are used in ritual contexts in many cultures.

¹⁹⁷ A *kalamos* is a reed, often used as the pipes of simple wind-instruments. Archytas is probably thinking of the way in which the sounding-lengths of the tubes of Panpipes were regulated; on Greek instruments of Archytas' time they were all the same length, but were blocked at different points along the length by being partly filled with wax. But he seems to be envisaging a sequence of such adjustments using only one pipe.

¹⁹⁸ The earliest surviving discussion of the 'intervallic' movement of sounds which is characteristic of melody is at Aristox. *El. harm.* 8.13–10.20; all later accounts of it are based on his. If Porphyry is right, Archytas had broached the subject half a century earlier, but we know nothing about his treatment of it. It is true that Nicomachus (*Harm.* 2) presents an exposition which he attributes to the Pythagoreans, but it cannot be based on Archytas' account; it is very plainly an adaptation of Aristoxenus' discussion, and the attribution is misleading.

αὐτὸς ἐργασάμενος, τὰ δ' ἐπιδραμῶν ὡς κυκλιζόμενα, αὐτάρκως ἡμῖν ἐπιδέδεικται.

- (5) Ἐπεὶ δ' οὐ μόνον διὰ ποσότητος ἀποτελεῖσθαι τὰς ὀξύτητας ἔφη καὶ τὰς βαρύτητας, ἀλλὰ καὶ ποσότητος εἶναι, ἐπιστήσειεν ἂν τις, <εἰ> καὶ ὀρθῶς λέγεται τὸ τοιοῦτον, καὶ ὅλως εἰς τὸν λεγόμενον τόπον τῆς φωνῆς, ὃν διέξεισιν ἀπὸ τοῦ βαρυτάτου ἄχρι τοῦ ὀξυτάτου, ποσοτήτων δεῖ θέσθαι διαφοράς. ἀλλ' οὐχὶ ποιοτήτων, μᾶλλον ποσοτήτων τε καὶ ποιότητων; ἄρχει μὲν γὰρ τὸ ποσόν, εἴ τέ τις τῶν φθόγων λέγειν ἐθέλοι, εἴ τε τῶν διαστημάτων, ἢ τε ταχυτῆς τῶν κινήσεων καὶ ἡ βραδυτῆς. ἡ δ' ἐπὶ ταύτης ὀξύτης καὶ βαρύτης τῶν φθόγων ποιότητές εἰσι καὶ οὐ ποσότητες, καλῶς καὶ τοῦ Ἀριστοτέλους αἰτίας μὲν ὀξύτητος καὶ βαρύτητος τὰ τάχη καὶ τὰς βραδυτήτας παραδεξαμένου, μηκέτι δὲ προσεμένου τὸ ταχυτῆτα εἶναι ἢ ταχεῖαν γε τὴν ὀξεῖαν φωνὴν ἢ βραδεῖαν τὴν βαρεῖαν. καὶ γὰρ ἐπὶ τῆς αὐξήσεως κατάρχει μὲν ἡ τοπικὴ κίνησις, ἐπιγίνεται δὲ ταύτῃ ἡ κατὰ τὸ ποσόν, οὐκ οὔσης τῆς τοπικῆς, ὡς τοῖς ἀκριβεστέροις ἐδόκει, κατὰ ποσόν. καὶ συγκρίσεων καὶ διακρίσεων ἡγουμένων ἐπιγίνεται ἀλλοιώσις, οἷον πυκνότης καὶ μανότης ποιότητες οὔσαι κατὰ τούτους καὶ οὐ ποσότητες, οὐδὲ κατὰ τόπον θέσεις.
- (10)
- (15)
- (20)

Σκοπουμένῳ δὲ τὴν τοῦ ὀξέος πρὸς τὸ βαρὺ διαφορὰν οὐδενὶ προσπίπτει οὔτε ὡς μείζονος μεγέθους πρὸς ἑλαττον μέγεθος ὑπεροχή, οὔτε ὡς πλείονος ἀριθμοῦ πρὸς ἐλάττονα, οὔτε ὡς ἡ τοῦ ἀρτίου πρὸς περιττὸν παραλλαγή, ἀλλὰ τις ἰδιότης ψόφων καὶ κατ' ἀλλοιώσιν ἑτερότης καὶ μᾶλλον ὡς ἡ τοῦ λευκοῦ πρὸς τὸ μέλαν διαφορὰ ἢ ὡς ἡ τῶν πέντε πρὸς τὰ τρία παραλλαγή. οὐδὲ γὰρ διαφέρειν ἂν ῥηθῇ τὰ πέντε τῶν τριῶν τοῖς δύο, ἅ γ' ἔνεστιν ἐν τοῖς τρισίν, ἀλλ' ἠϋξῆσθαι μᾶλλον καὶ ὑπε-

(25)

6 <εἰ> add. Düring 10 ἄρχει] ἀρχή g ἐθέλοι λέγειν T 13 καὶ βαρύτητος om. T
19 ἐπιγίνεται Alexanderson ἐπιγίνεσθαι codd. 26 ἂν] ἀεί g

championed, working out some things for himself and just touching on others, since they were in familiar currency.

| But since he says not only that high and low pitch are produced through quantities, but also that they *are* quantities, one should focus on the question whether he is right to say such a thing, and in general, whether one must assign differences of quantity to what is called the ‘space’ of the voice, which it traverses from the lowest <note> to the highest. But should not <one assign to it differences> of quality, or rather of both quantity and quality?¹⁹⁹ | For it is quantity that takes the lead; it is the swiftness and slowness of the movements, no matter whether one chooses to speak of notes or of intervals. But the resulting height and depth of the notes are qualities and not quantities, and Aristotle did well to accept swiftnesses and slownesses as causes of high and low pitch, and not to add | that a high voice is swiftness, or swift, or a low one slow.²⁰⁰ Thus in the case of growth it is change in place that takes the lead, and change in quantity follows upon it, although in the view of the most meticulous writers a change in place is not a change in quantity. And when combinations and separations take the lead, alteration²⁰¹ also arises – denseness and diffuseness, for instance, | which according to these people are qualities and not quantities, and not positions in place either.²⁰²

When one considers the difference between high and low pitch, it strikes no one as the excess of a larger magnitude over a smaller, or as that of a greater number over a smaller, or as the contrast between the even and the odd, but as a qualitative characteristic (*idiotēs*)²⁰³ of sounds and an otherness due to alteration, and | as more like the difference between white and black than like the contrast between five and three. For one would not say that five differs from three ‘by two’, since the two are already there

¹⁹⁹ I have changed Düring’s punctuation of 58.7–10 fairly radically, to include the words ‘and in general . . . to the highest’ in the question on which Porphyry says we should focus, and to convert ‘But should not . . . quantity and quality’ into a question. Düring’s punctuation puts a full stop after ‘say such a thing’, and continues: ‘And in general, one must assign differences of quantity but not of quality, or rather of both quantity and quality, to what is called . . . to the highest’, which seems less coherent and fits less well into its context.

²⁰⁰ Aristotle *De anima* 420a–b, cited above at 47.13–23.

²⁰¹ ‘Alteration’ translates *alloiōsis*, which in such contexts always refers to qualitative change.

²⁰² The language of this passage and its mode of presentation are close to those of Plot. *Enn.* 6.3.25.1–15, and in his allusion to the ‘more meticulous writers’ Porphyry may possibly have had Plotinus in mind. (I owe these observations to Massimo Raffa.)

²⁰³ Here, as again at 59.31, 61.7 and 65.19, Porphyry has borrowed the term *idiotēs* (whose basic meaning is ‘characteristic peculiar to its possessor’) from Theophrastus in the passage quoted below (61.22–65.15), where it is used repeatedly to designate a quality by contrast with a quantity. Porphyry uses it for the same purpose. The present paragraph in fact owes a good deal to the Theophrastan fragment, in its reasoning as well as its vocabulary.

- ρέχειν. ἡ δ' ὀξύτης τῆς φωνῆς οὐκ ἦν τῆς βαρύτητος αὐξησις ἀλλ' ἀλλοίωσις μᾶλλον. ἔνεστι γοῦν τηροῦντα τὴν βαρύτητα σφοδρύνειν καὶ
- (30) τὴν ὀξύτητα ἡρέμα προφέρειν καὶ ὁμως τηρεῖν τὴν παραλλαγὴν τῷ μὴ ποσότητος εἶναι αὐτάς, ἀλλὰ καὶ ποιότητος, ὡς αὖξιν τὸ ποσὸν τοῦ μέλανος καὶ μειοῦν τὸ λευκὸν τῆς κατὰ τὴν χροάν διαφορᾶς μενούσης ἀπαραλλάκτου.
- (59) Σαφῶς δ' ἡμῖν διὰ τῶν συμφωνιῶν τὸ λεγόμενον ἐπιδειχθήσεται. τῆς γὰρ διὰ πασῶν φέρε συμφωνίας ὑποκειμένης ἐγχωρεῖ σφοδρότερον πλήττειν τὸν βαρύτερον φθόγον, ἡρέμα δὲ τὸν ὀξύτερον· καὶ ὁμως τοῦ ψόφου σφοδρότερου ἀποδιδόμενου ἀπὸ τοῦ βαρυτέρου μένει ἡ συμφωνία
- (5) ἀπαραλλάκτος. εἰ δ' ἦσαν ποσότητες αὐξηθέντος τοῦ ποσοῦ ἢ μειωθέντος διὰ τῆς σφοδρότητος θατέρου, οὐκ ἔτ' ἂν ἔμεινεν ἡ συμφωνία τῆς κατὰ τὴν κρᾶσιν ὁμοιότητος ἀναιρεθείσης, ἐξ ἧς οἶμαι ἐναργέστατα φαίνεται ποιότης οὕσα ἡ ὀξύτης καὶ ἡ βαρύτης· διὸ καὶ τηροῦσι τὴν πρὸς ἄλληλα διαφοράν, ὡς τὸ μέλαν πρὸς τὸ λευκόν, κἄν τὸ μὲν ἢ
- (10) πηχυαῖον, τὸ δ' ὅσον τὸ ὄρος, κατ' ἄλλην γὰρ αἰτίαν ἢ ἀλλοίωσις, κἄν ἐλαχίστη γένηται προσθήκη ἢ ἀφαίρεσις, τοῦ δ' αὐτοῦ τὸ πλήθος ἢ ὀλιγότης τὴν κατὰ ποιότητα οὐκ ἐξίστησι διαφοράν. πλανᾷ δὲ τὸ ἐπιγίνεσθαι ἀριθμοῖς τισι καὶ μέτροις τῆς κινήσεως τὰς ὀξύτητας καὶ βαρύτητας· δέον συνορᾶν, ὅτι καὶ οὐσίαι ἀριθμοῖς τισι καὶ λόγοις ἀριθμητικοῖς ἐπιγίνονται καὶ ποιότητες, ὡς δ' οἶονται οἱ Πυθαγόρειοι, καὶ πάντων αἵτιοι οἱ ἀριθμοί, ἀλλ' οὐδήπου πάντα ποσὰ διὰ τοῦτο. εἰ δ' ἦν ποσότης φέρε ἡ βαρύτης, δύο ἂν ποτε ψόφοι βαρεῖς ληφθέντες, ἢ διπλασίονι δυνάμει, ἢ κατὰ τὸ βαρὺ ἡρμοσμένη χορδὴ κρουσθεῖσα ὀξὺν ἂν ἀπετέλεσε τὸν φθόγον· ὡσαύτως δὲ καὶ ἡ ἐπὶ τὸ ὀξὺ ἡρμοσμένη βίβη
- (20) μὲν κρουσθεῖσα ὀξὺν ἀπεδίδου τὸν ἥχον, ἡρέμα δὲ καὶ ὑπὸ δυνάμεως ἐλάττονος βαρύν.

4 μείνη p 8 φαίνεσθαι g 12 οὐκ om. g ἐξήσῃ g 13 ἀριθμοῖς — 14 οὐσίαι om. Mg
14 post ἀριθμητικοῖς add. τισι G 16 ποσὰ Alexanderson δσα codd.

in the three, but rather that it has increased and exceeds <the three>.²⁰⁴ But the height of the voice is not an increase of heaviness; it is rather an alteration. Thus it is possible to exert vigour while preserving low pitch, and | to produce a high pitch gently while still preserving the contrast, because these are not quantities but qualities, just as it is possible to increase the quantity of black and to reduce the white while the difference in colour remains unchanged.

We shall demonstrate clearly what has been said by reference to the [59D] concords. For if we take the concord of the octave, for example, it is possible to strike the lower note more vigorously and the higher gently; and though the sound produced from the lower note is more vigorous, the concord nevertheless remains | unchanged. But if they were quantities, when the quantity of either note was increased or diminished in vigour the concord would no longer remain, since the similarity involved in the blend would have been destroyed.²⁰⁵ From this it seems to me very clear that high and low pitch are qualities. That is why they remain different from one another, as does black in relation to white. No matter whether one of them²⁰⁶ is | a cubit long while the other is the size of a mountain, or whether the addition or subtraction is very small, alteration has a different cause, and the multitude or smallness does not eliminate the difference in quality. The idea that high and low pitches supervene upon certain numbers or measures of movement is misleading. We must observe that in the Pythagoreans' opinion essences and qualities | do supervene upon certain numbers and numerical ratios, and numbers are the causes of all things; but they certainly do not believe that for this reason all things are quantities.²⁰⁷ If low pitch, for instance, were a quantity, then if we had two low sounds, or if the string tuned to a low pitch was struck with double the force, it would make the note high; and in the same way when a string tuned to a high pitch was struck | with force it would make the sound

²⁰⁴ Porphyry may be thinking of the well-known passage at Plato *Phaedo* 100e–102a (particularly 101b), though he does not pursue the intricacies of its argument. I take the first part of the sentence to mean that one cannot say that 5 differs (in character) from 3 by including 2, since 2 is also present in 3.

²⁰⁵ For the thesis, unanimously adopted by Greek theorists, that notes in concord with one another form an intimate 'blend' (*krasis*), see for instance the remarks of Aelianus quoted above at 35.26–36.3, and the statements on the subject reported at 95.25–96.28 below.

²⁰⁶ 'Them' refers to hypothetical patches of white and black.

²⁰⁷ This seems inconsistent with Aristotle's account of Pythagorean views at *Metaph.* 985b–986a. But Porphyry writes here in the present tense, and he may be thinking of doctrines current among Pythagorising philosophers of his time. In any case these Pythagoreans are unlikely to be identical with the musical theorists called 'Pythagoreans' elsewhere in the commentary.

- Πῶς οὖν αἱ συμφωνίαι ἐν ἀριθμοῖς καὶ ἡ διὰ πασῶν φέρε ἐν διπλα-
σίονι λόγῳ θεωρεῖται ἀπὸ τε τοῦ ἐνὸς φθόγγου θατέρου τοσοῦτῳ ὑπερέ-
χειν λεγομένου; ὅτι δεῖ μὲν καὶ τὴν κατὰ ποιότητα αἰτίαν προσεῖναι.
- (25) ὥσπερ φέρε κἄν ταῖς συσταθμαῖς τῶν φαρμάκων—ἄνευ γὰρ μέτρων
καὶ ἀριθμῶν ἀδύνατος ἡ σύστασις, ἀλλ' ὅμως ποιότης ἦν ἡ τοῖς ἀριθ-
μοῖς καὶ ταῖς συμμετρίαις ἐπιγινομένη—οὕτω γὰρ καὶ ἡ τῶν φθόγ-
γων ὀξύτης τε καὶ βαρύτης· εἰ καὶ τῷ ποσῷ τῶν πληγῶν ἐπιγίνεται,
ἀλλ' αἰτία γε οὐ ποσότης ἀλλὰ ποιότης. ἐπιστήσας δὲ τις τῇ φωνῇ
- (30) σαφῶς εἴσεται οὐκ οὔσαν τὴν ὀξύτητα καὶ τὴν βαρύτητα οἷον ἔκτασιν ἢ
συστολήν καὶ ταχυτῆτα ἢ βραδυτῆτα· ἰδιότητος δὲ παραλλαγὴν, καθ'
ἣν καὶ ἐν τῇ λογικῇ φωνῇ ἄλλαι μὲν εἰσιν αἱ ἐκτάσεις καὶ συστολαὶ τῶν
συλλαβῶν αἵ τε μακρότητες καὶ αἱ βραχύτητες, ἄλλαι δ' αἱ ταχυτῆτες
καὶ αἱ βραδυτῆτες, ἄλλαι δ' ὀξύτητες καὶ βαρύτητες. διὸ ταῖς μὲν χρῆ-
- (60) ται ἡ ῥυθμική, ταῖς δ' ἡ μετρική, ταῖς δ' ἡ ἀναγνωστική, περὶ τὴν
ποιὰν προφορὰν τῶν λέξεων πραγματευομένη. ὅλως δὲ τῶν κατὰ τὰς
αἰσθήσεις θεωρουμένων αἰσθητῶν ἐν ποσῷ καὶ ποιῷ ὑφισταμένων, μὴ
μόνον τὰς ἐκτάσεις καὶ τὰς συστολάς, τὰς τε ταχυτῆτας τῶν προφορῶν
- (5) παρὰ τὰς βραδυτῆτας τιθεὶς ἐν ποσῷ καὶ ὅσα τούτοις σύστοιχα, ἀλλὰ
καὶ τὰς ὀξύτητας καὶ τὰς βαρύτητας ἀνάγων εἰς τὸ ποσὸν κινδυνεύσει
μόνον τὸ ποσὸν κατὰ τὰ ἀκουστὰ παραλαμβάνειν, τὸ δὲ ποιὸν ἐκκλείειν
ἀπὸ τούτων. οὐ γὰρ καὶ τὰς λειότητας καὶ τὰς τραχύτητας καὶ εἴ τινα
τοιαῦτα περὶ τῶν ψόφων λέγεται, πειράσεται τις ὑπάγειν τῷ ποσῷ, καὶ
- (10) πᾶν, ὅπερ ἂν τις συγχωρῇ εἶναι τῆς ποιότητος. ὥς δ' γε Πτολεμαῖος
ἄτοπος τὴν μὲν πυκνότητα καὶ λεπτότητα καὶ παχύτητα παρὰ τὸ ποσὸν
τῆς οὐσίας συνισταμένας συγχωρῶν εἶναι ποιότητας, τὰς δὲ παρὰ τὴν
πυκνότητα καὶ λεπτότητα, μανότητά τε καὶ παχύτητα ποιότητας οὔσας
ὑφισταμένας, ὀξύτητας καὶ βαρύτητας μηκέτι διδούς εἶναι ποιότητας,
- (15) ἀλλὰ ποσότητας τῷ τὰς αἰτίας αὐτῶν παρὰ τὸ ποσὸν τῆς οὐσίας ὑφιστά-

23 τοσοῦτον g 24 ποιότητα] ποσότητα Wifstrand 27 ὑπαγινομένη T 29 τις om. T
31 παραλλαγή Mg

6 τὰς^{sec.} om. g 11 ante καὶ^{sec.} add. μανότητά τε G 15 ἀλλὰ ποσότητας om. T τῷ T τὸ ceteri

[*ēchos*] high, whereas when struck gently and with less power it would make it low.

How, then, are the concords conceived as being ‘in numbers’, and the octave, for instance, as being in double ratio, where the one note is said to exceed the other by the same amount again? It is because the cause concerned with quality must also be present. | Just as is the case in the weighing of drugs in relation to one another – since without measures and numbers they cannot be composed, and yet what supervenes on the numbers and proportions is a quality – so it is with the height and depth of notes; even if it supervenes on the quantity of the impacts, the cause is not a quantity but a quality. Anyone who concentrates closely on the voice | will understand that height and depth are not like extension and contraction or swiftness and slowness, but are a difference in qualitative character (*idiotēs*), in accordance with which, in the voice used in speaking too, the extensions and contractions and longs and shorts of the syllables are one kind of thing, the swiftnesses and slownesses another, and the high and low pitches another. This is why rhythemics uses one of them, metrics another, and reading aloud, which is concerned with the qualitative production of the words, uses another.²⁰⁸

[60D]

In general, given that the perceptible attributes grasped through the senses consist in quantity and in quality, a person who not only places in the class of quantity the extensions and contractions of utterances, their swiftnesses | in relation to their slownesses, and other things of similar sorts, but also brings their high and low pitches into the class of quantity, runs the risk of accepting only quantity in the domain of audible things and excluding quality from them. But surely no one will try to subordinate smoothnesses and roughnesses to quantity, or anything else of that sort that is attributed to sounds, and | everything that anyone would agree belongs to quality. So it is strange that Ptolemy accepts both that denseness and thinness and thickness are constituted in accordance with the quantity of substance and that the resulting denseness and thinness and diffuseness and thickness are qualities, while not conceding that height and depth are qualities, | but saying that they are quantities because their causes are

²⁰⁸ In these two sentences the ‘swiftnesses and slownesses’ must be those measuring the rates at which the syllables of the utterance are enunciated, not those that determine the sounds’ pitches. Porphyry’s main point is that the quantitative variables measured in rhythemics and metrics are quite distinct from the variations in pitch which appear only when the words are read aloud, and have no effect on them. Since metrics is clearly concerned with the lengths of syllables, Porphyry must mean that the business of rhythemics is with ‘swiftness and slowness’; this seems a rather odd representation of its subject-matter, but no other interpretation of the passage seems possible.

ναι. ἄτοπος δὲ καὶ παρὰ μὲν τὸ ποσὸν μὴ ἀπογινώσκων συνίστασθαι ποιότητα, παρὰ δὲ τὴν ταχυτῆτα καὶ βραδυτῆτα, διό ἦσαν ποσότητες, ἐξ ἀνάγκης τὰς ἐπισυνισταμένας αὐταῖς ὀξύτητας καὶ βαρύτητας ἀξιῶν εἶναι ποσότητας.

- (20) Θεάσαι δὲ καπὶ τῶν ἄλλων αἰσθητῶν τὴν ὀξύτητα καὶ τὴν βαρύτητα, τίνι τις ἂν τῶν γενῶν ὑπάγοι. οὐκοῦν ἵνα τις ἀπὸ τῶν στοιχείων ἄρξηται, ἢ μὲν γῆ παχεῖα τ' οὕσα καὶ ψυχρὰ ἅμα καὶ βραδυκίνητος, καθ' ἑαυτὴν δὲ καὶ ἀκίνητος, ἐστὶ βαρυτάτη· τὸ δὲ πῦρ λεπτὸν τε ὄν καὶ θερμὸν καὶ ταχυκίνητον, ἐστὶν ὀξύτατον. καὶ οὐδεὶς ἂν εὐφρονῶν τὴν
- (25) τοῦ πυρὸς κατ' ὀξύτητα διαφορὰν πρὸς τὴν τῆς γῆς κατὰ βαρύτητα ποσοῦ ἂν εἴποι εἶναι διαφορὰν, καίτοι κατὰ ποσὸν ἐστὶ τις παραλλαγή τοῖς στοιχείοις. καὶ μὴν καὶ κατὰ τὴν γεῦσιν· ὁ μὲν τις οἶνός ἐστι γλυκὺς ἀλλὰ παχύς, ὁ δ' αὖστηρὸς ἀλλὰ λεπτός· καὶ οὐχ ἡ γλυκύτης ἦν παχύτης, οὐκ αὖστηρότης προσῆν λεπτότητος, ἀλλὰ μόνῃ ἡ γλυκύτης
- (30) τῆς, ὥ ἡ παχύτης, καὶ ἡ αὖστηρότης, ὥ ἡ λεπτότης· αὐτὴ τε ἡ παχύτης ὑφίστατο, ἐφ' οὗ τὸ ποσὸν τῆς οὐσίας ἦν πλεῖον, ἡ δὲ λεπτότης, ἐφ' οὗ τὸ ποσὸν ἔλαττον. τί οὖν κωλύει καὶ ἐπὶ τῶν τόνων, εἰ καὶ ταῖς λεπτοτέραις φέρε χορδαῖς οἱ ὀξεῖς ἐπιθεωροῦνται φθόγγοι, εἰ καὶ ταῖς ταχείαις κινήσεσιν, εἰ καὶ τῷ ποσῷ μετέχει τῶν πληγῶν, μὴ εἶναι τὴν ὀξύτητα
- (61) ποσότητα; οὐδὲ γὰρ ποσὸν τι ἡ ὀξύτης, οὐδ' ἡ βαρύτης, ἀλλὰ τοιόνδε μᾶλλον· οὐδ' ἴσον ἢ ἄνισον, ἀλλ' ὅμοιον ἢ ἀνόμοιον τὸ καθ' ἑκατέραν ἰδίωμα, ἃ δὴ τὸ ποιὸν ἀλλ' οὐ τὸ ποσὸν χαρακτηρίζειν ἐπεφύκει. ἐπὶ τε τῶν ὁσμῶν αἱ ὀξεῖαι ταῖς βαρεῖαις οὐ κατὰ ποσότητα κέκτηνται τὴν
- (5) διαφορὰν, ἀλλὰ κατὰ ποιότητα. καὶ γένοιτο μὲν ἂν ὀξέος ὀξύτερον καὶ βαρέος βαρύτερον· οὐκ ἂν δὲ τὸ ὀξύτερον βαρέος ἂν λέγοιτο ὀξύτερον, οὐδὲ τὸ βαρύτερον ὀξέος βαρύτερον. ἰδιότης γάρ ἐστι ψόφων καὶ ἡ ὀξύτης καὶ ἡ βαρύτης, ὥς ὁρατῶν αἱ χροαὶ χυμοὶ τε γεύσεως καὶ ὁσμῶν

17 ποιότητα om. g 18 αὐταῖς] αὐτάς g 20 θεάσαι g 30 ὥ bis ETV¹⁸⁷ δ Mg

3 ἐπιπεφύκει mG 6 βαρέος – ὀξύτερον om. T

constituted by the quantity of substance. It is strange, too, that he does not deny that a quality can be constituted on the basis of quantity, but still thinks that in the case of swiftness and slowness, since they are quantities, the high and low pitches (sharpness and heaviness) whose constitutions arise from them must necessarily be quantities.

| Consider also to which category one would subordinate the sharpness and heaviness that occur in other perceptible things. To begin from the elements, earth, which is thick and also cold and slow moving, in itself in fact unmoved, is the heaviest; while fire, which is thin and hot and swift moving, is the sharpest. No one in their senses would say that the | difference between the sharpness of fire and the heaviness of earth is a difference of quantity, even though there is a contrast in quantity between the elements. Again, in the domain of taste, one kind of wine is sweet but thick and another is sour²⁰⁹ but thin. It is not that the sweetness belongs to the thickness or the sourness to the thinness, but that wine has sweetness only | when it has thickness, and sourness only when it has thinness; and thickness itself arises in a thing whose quantity of substance is greater, and thinness in one whose quantity is smaller. What then prevents it from being the case in pitches (*tonoi*) too, that even if the sharp (high-pitched) notes are observed in the thinner strings, for instance, or in swift movements, or if sharpness lies in the quantity of the impacts, sharpness is not a [61D] quantity.

For sharpness is not a quantity, and neither is heaviness, but rather a being-such.²¹⁰ Nor is the special attribute (*idiōma*) which each bears equal or unequal, but like or unlike, which by their nature characterise quality and not quantity. In smells, once again, sharp ones do not acquire their difference from heavy ones in correspondence with a quantity | but with a quality. And there can be a sharper thing than a sharp one and a heavier than a heavy one; but one would not say that the sharper is sharper than a heavy, or that the heavier is heavier than a sharp one.²¹¹ For sharpness (high pitch) is an *idiotēs* of sounds, and so is heaviness (low pitch),

²⁰⁹ The Greek is *austēros*. Anglophone wine-lovers would usually say 'dry', but I avoid the term here to prevent confusion with 'dry' in the sense opposed to 'wet'.

²¹⁰ 'A being-such' translates *toionde*, a word indicating that the 'suchness' is qualitative.

²¹¹ It is hard to translate Porphyry's Greek in a way that expresses this point convincingly in English. What probably underlies it is the fact that heaviness and sharpness are not different values of the same variable (cf. Euclid quoted at 90.24); we cannot say that the sharpness of X is higher or lower on some scale of measurement than the heaviness of Y. The same conclusion will hold even if they are thought of as mutually incompatible attributes of the same general kind, like e.g. pink and green in the case of colours, which is mentioned in the next sentence.

- αί κατὰ τὰ ὁσφραντὰ διαφοραί. ὅλως τέ τινα οὐκ ἐκωλύετο ἐν πλείοσι
 (10) θεωρεῖσθαι κατηγορίαις καθάπερ τὰ γεωμετρικά σχήματα, καθ' ὃ μὲν
 μεγέθη ἐτύγχανεν ὄντα ἐν ποσῶ, καθ' ὃ δὲ τοιάνδε μορφήν παρείχετο
 ἐν ποιῶ. τί οὖν ἐκώλυσε καὶ τοὺς ψόφους, καθ' ὃ μὲν ἐν ταχυτῆσιν ἢ
 βραδυτῆσι θεωροῦνται, εἶναι ἐν ποσῶ, καθ' ὃ δ' ἐν ὀξύτησι καὶ βαρύτησι,
 ποιότητι διαλλάττειν; πλείους δ' ἂν ἔτι παρέσχον πίστεις πρὸς τὸ πρᾶγ-
 (15) μα, εἰ μόνος αὐτὸς ἐγνωκῶς ἐτύγχανον.

- Νῦν δ' ἴσως μὲν καὶ ἄλλοι πλείους συμφέρονται μοι, οὓς ἀπορία τῶν
 συγγραμμάτων οὐκ ἔχω καταλέγειν ἐπ' ὀνόματος. ἀντὶ πάντων δέ μοι
 ἀρκέσει Θεόφραστος διὰ πλειόνων καὶ ἰσχυρῶν, ὥς γ' ἑμαυτὸν
 πείθω, τοῦ δόγματος δείξας τὴν ἀτοπίαν ἐν τῷ δευτέρῳ Περὶ μου-
 (20) σικῆς, οὗ τὴν λέξιν ἀναγραπτέον καὶ ἀξιοτέον τοὺς ὑπὲρ τοῦ Πτο-
 λεμαίου ἰσταμένους εὐθύνειν τὰ λεγόμενα ἔχοντα οὕτως.

- “Ἔστι γὰρ τὸ γινόμενον κίνημα μελωδικὸν περὶ τὴν ψυχὴν σφόδρα
 ἀκριβές, ὁπόταν φωνῇ ἐθελήσῃ ἐρμηνεύειν αὐτό, τρέπει μὲν τήνδε, τρέ-
 (25) πει δ' ἐφ' ὅσον οἷα τ' ἐστὶ τὴν ἄλογον τρέψαι, καθ' ὃ ἐθέλει ἢς τὴν
 ἀκρίβειάν τινες ἐπεβάλλοντο εἰς τοὺς ἀριθμοὺς ἀναπέμπειν, κατὰ τοὺς ἐν
 τούτοις λόγους τὴν ἀκρίβειαν τῶν διαστημάτων γίνεσθαι φήσαντες. ἔνα
 γὰρ λόγον εἶναι τοῦ διὰ πασῶν ἔφασαν ὥς καὶ τὸν τοῦ διπλασίου, καὶ
 τὸν τοῦ διὰ πέντε ὥς τὸν τοῦ ἡμιολίου, καὶ τὸν τοῦ διὰ τεσσάρων ὥς
 τὸν τοῦ ἐπιτρίτου· καὶ τῶν ἄλλων δὲ διαστημάτων ἀπάντων ὁμοίως,
 (30) ὥσπερ καὶ τῶν ἄλλων ἀριθμῶν ἐκάστου ἴδιον. οὕτω τ' ἐν ποσότητι τὴν
 (62) μουσικὴν εἶναι, ἐπειδὴ παρὰ τήνδε αἱ διαφοραί. ἃ δὲ λέγοντες συνετώ-
 τεροὶ τισιν ἐφαίνοντο τῶν ἀρμονικῶν καὶ αἰσθήσει κρινόντων τοῖς τῶν
 νοητῶν ἀριθμῶν λόγοις ἐπικρίνοντες, οἳ οὐκ ᾔδεσαν, ὅτι εἰ μέντοι ποσό-

14 ποιότησι g
 26 φήσαντος T

15 ἐτύγχανεν g
 28 τόν^{prim.} om. T

22 μελωδικόν g
 30 οὕτω] ὥστε T

23 φωνήν T αὐτό] αὐτόν g

just as are colours of visible things, flavours of taste, and differences in odour of smells.²¹² In general, there is nothing to prevent some things | from being understood as belonging to several categories, as are geometrical shapes, which are in the category of quantity in so far as they are magnitudes, but in that of quality in so far as they present such and such a form. What then prevents sounds too from being in the category of quantity in so far as they are apprehended as swift and slow, but differing in quality in so far as they are apprehended as high pitched and low pitched?²¹³

I would provide many more pieces of evidence in support of my case | if I were the only person who knew about them. As it is, however, perhaps there are many who agree with me, though through lack of their writings I cannot list them by name. Theophrastus will be enough for me in place of them all, since he demonstrated the absurdity of the doctrine through many arguments, powerful ones, as I believe, in the second book of his *On Music*. | It will be appropriate to write out what he said, and to reckon that his remarks are capable of correcting those who take Ptolemy's side. They are as follows.

The melody-making movement that occurs in the soul is very accurate, when it [the soul] wishes to express it [the movement] with the voice; it turns it [the voice], and turns it just as it wishes, to the extent that it is able to turn what is non-rational. Some people | decided to refer its accuracy to numbers, saying that the accuracy of the intervals arises in accordance with the ratios between numbers. For they said that the ratio of the octave is the same as that of the double, the ratio of the fifth the same as that of the hemiolic, and the ratio of the fourth is the same as that of the epitritic; and that for all the other intervals, in the same way, | just as for the other numbers, there is a ratio peculiar to each. Hence they said that music consists in quantity, since it is on this that the differences are based.

[62D]

In saying this they seemed to some people to have more understanding than the *harmonikoi*, who judge by perception, since they judged by the ratios of intelligible numbers. They did not realise that if the difference is

²¹² Here the term *idiotēs*, which I have previously translated as 'qualitative character', seems to carry an additional implication. I take Porphyry to mean that although the word 'sharp', for instance, can refer to qualities of things of several sorts (knives, sounds and flavours, for instance), the quality it designates in connection with sounds exists only in the domain of sound, just as colour exists only in the realm of visible things. In that case the sharpness of sound cannot be a quantitative attribute, since all quantitative attributes can be shared across several domains.

²¹³ Cf. n. 211 above. From this point onwards I shall no longer translate *oxys* and *barys* literally, as 'sharp' and 'heavy', when they refer to sounds, or add reminders in brackets, although it will often be useful to bear these connotations in mind; I shall revert to the policy of representing them simply as 'high' and 'low'.

- της ἐστὶν ἡ διαφορά, γίνεται αὕτη παρὰ τὸ ποσότητι διάφορον, κἄν
- (5) μέλος ἢ μέλους μέρος εἴη· ὥστε καὶ εἰ χρώα χρώας ποσότητι διαφέρει, ὅπερ ἀνάγκη, κἄν μέλος ἢ μέλους <μέρος> εἴη, εἴ γε τὸ μέλος καὶ τὸ διάστημα ἀριθμὸς καὶ διὰ τὸν ἀριθμὸν τὸ μέλος καὶ ἡ τοῦδε διαφορά. καὶ γὰρ εἰ πᾶν διάστημα πλήθός τι, τὸ δὲ μέλος ἐκ διαφορῶν φθόγγων, τὸ μέλος ὅτι ἀριθμὸς τοιόνδε ἂν εἴη· ἄλλ' εἰ μηδὲν ἄλλο <ἡ> ἀριθμὸς, πᾶν
- (10) ἀριθμητὸν μετέχει ἂν καὶ μέλους, ὅσον καὶ ἀριθμοῦ. εἰ δ' ὡς τῷ χρώματι συμβέβηκε τὸ πλήθος ἄλλω ὄντι καὶ τοῖς φθόγγοις, ἔστι τι ἄλλο φθόγγος καὶ ἄλλο τὸ περὶ αὐτὸν πλήθος· ἄλλ' εἰ ἄλλο τι φθόγγος ἢ ἀριθμὸς, καὶ ὁ βαρύτερος καὶ ὁ ὀξύτερος διαφέρουσιν ἀλλήλων ἢ ὡς φθόγγοι ἢ ὡς τῷ πλήθει. εἰ μὲν τῷ πλήθει, καὶ ἔστιν ὁ ὀξύτερος
- (15) τοιοῦτος τῷ πλείονας ἀριθμοὺς κενιῆσθαι καὶ ὁ βαρύτερος τῷ ἐλάττους, τί ἄλλο τὸ ἴδιον τῆς φωνῆς ἂν εἴη; πᾶσα γὰρ ἀντιληπτική ἢ κατὰ τὸ ὀξύ ἢ κατὰ τὸ βαρὺ ἐστὶ. πᾶσα γὰρ φωνὴ ἐστὶν ἥς μὲν ὀξύτερα, ἥς δὲ βαρυτέρα, ὥστε ἥς μὲν ἔλαττον τὸ πλήθος, ἥς δὲ πλεῖον, ὥστε ἀριθμὸς· οὗ αἰρομένου τί τὸ ἀπολειπόμενον εἴη ἄλλο τι καθ' ὃ φωνή; ἢ
- (20) φωνὴ δ' εἰ ὀξύτερα τινὸς ἢ βαρυτέρα ἐστίν, ἔχει τὸ ποσὸν ἢ φωνή, εἰ δ' ἄλλο τι, οὐκ ἔτι ἔσται φωνὴ τις. εἰ δ' ἢ φθόγγοι διοίσουσιν ἀλλήλων οἱ ὀξεῖς καὶ βαρεῖς, οὐκέτι τοῦ πλήθους δεησόμεθα· ἡ γὰρ αὐτῶν φύσει διαφορά αὐτάρκης ἔσται εἰς τὴν τῶν μελῶν γένεσιν, καὶ εἰδησις ἔσται τῶν διαφορῶν. οὐκέτι γὰρ ἔσονται διαφοραὶ παρὰ τὰ πλήθη ἀλλὰ παρὰ
- (25) τὴν ιδιότητα τῶν φωνῶν ὥσπερ ἐν τοῖς χρώμασιν· οὐδὲν γὰρ χρῶμα ἀπλοῦν ἀπλοῦ χρώματος ποσότητι διαφέρει· ἴσαι γὰρ ἂν εἴεν αἱ ποσότητες, ὥσπερ εἰ συμμιγείη ἢ μέλαν λευκῷ, ἴσῳ ἴσον, οὐκ ἂν οἱ τοῦ λευκοῦ ἀριθμοὶ τῶν τοῦ μέλανος πλείους λέγοιντο, οὐδ' ἂν οἱ τοῦ μέλανος τῶν τοῦ λευκοῦ· οὕτως οὐδὲ τῷ γλυκεῖ πικρόν· ἕκαστον γὰρ καθ' ὃ ἐπι-
- (30) τέταται ἴσον· ἄλλ' ἔστι τὸ πλήθος ἐπ' ἴσον ἐπιτεταμένον κατὰ τὸ ἴδιον. οὕτως οὐδὲ ἡ ὀξεῖα φωνὴ ἐκ πλειόνων συνέστηκεν ἢ πλείους ἀριθμοὺς κινεῖται, οὔτε ἡ βαρεῖα· οἷόν τε γὰρ καὶ ταύτην λέγειν ἢ κάκεινην, ἐπειδὴ ἴδιόν τι μέγεθος βαρείας ἐστὶ φωνῆς.

5 εἰ m ἢ ceteri διαφέρει Düring διαφέρει codd. 6 <μέρος> add. Wallis κἄν – εἴη del. Düring εἰ] ἡ g 8 τὸ μέλος om. p 9 <ἡ> add. Schneider 10 εἰ] ἡ Düring 11 συμβέβηκε Schneider συμβεβήκοι codd. 12–13 ἡ ἀριθμὸς scripsi ὁ ἀριθμὸς Wallis ὁ ἀκουστός Schneider ἡ ἀκουστός codd. 14 τῷ^{prim.}] τὸ p 19 τὸ om. T 20 εἰ^{prim.} scripsi ἡ codd. 25 οὐδέ] οὐδὲ p 29 τῷ om. ET γλυκύπικρον ETV⁸⁷p 29 ἐπιτετάκεται Schneider 30 ἐπιτεταμένῳ MG ἐπιτεταγμένῳ p

a quantity, this difference arises along with a difference in quantity,²¹⁴ and | must be a melody or part of a melody. Thus even if one colour differs from another in quantity, as it must, it must be a melody or part of a melody, if indeed melody and interval are a number, and if melody and the difference involved in it exist because of the number. For if every interval is a plurality, and if melody arises from different notes, the melody must be as it is because it is a number. But if it were nothing but a number, everything | numerable would participate in melody too, to the extent that it participates in number. If, however, plurality belongs to notes in the same way as it does to colour, colour being something different <from the plurality>, then a note is one thing and the plurality related to it is another. But if a note is something other than a number, the lower and the higher note differ from one another either as notes or in their plurality. If it is in their plurality, and if the higher | is as it is by being moved in respect of more numbers, the lower by being moved in respect of fewer, what else could be the attribute peculiar to the voice?²¹⁵ For every voice is such as to be apprehended either as high or as low. For every voice is higher than this one and lower than that, so that its plurality is smaller than one of them and greater than the other, and hence is a number. When this is taken away, what else could be left to make it a voice? And if | a voice is higher or lower than another, the voice possesses quantity, but if it possesses something else <and not quantity> it will not yet be a voice. But if it is as notes that high and low notes differ, we shall no longer have need of plurality, since their own natural difference will be sufficient by itself for the production of melodies, and there will be knowledge of the differences. For the differences will no longer exist on the basis of the pluralities, but on the basis of | the quality peculiar to voices,²¹⁶ as is the case with colours. For no colour considered simply as such differs in quantity from another colour considered simply as such; the quantities may be equal, just as when one mixes black with an equal amount of white, the numbers of the white would not be said to be more than those of the black, nor those of the black than those of the white. Nor <would they if> bitter <were mixed> with sweet, since each is equal | in its intensity; with respect to its plurality it is equally intensified in its own special quality.²¹⁷ Thus a high voice is not composed of more numerous <elements>, nor does it move in accordance with more numbers; and neither is a low one (for one can say this of the latter as well as the former, since there is a characteristic magnitude that belongs to a low voice).

²¹⁴ That is, on this hypothesis the difference in question will arise *wherever* there is a difference in quantity.

²¹⁵ Throughout this passage Theophrastus' main focus is on the human voice, for reasons that are made clear at the beginning and the end, and (except in certain special cases, where he refers to specific kinds of sound as *ēchoi*) he consistently designates his subject either as a 'voice' (*phōnē*) or as a 'note' (*phthonggos*). But he also discusses the sounds of instruments, and it seems clear that he would have applied his arguments to pitched sounds of any sort.

²¹⁶ 'The *idiotēs* of voices'; cf. n. 203 above.

²¹⁷ Or 'its plurality is equally intensified with respect to its own special quality'.

- (63) Δῆλον δ' ἐκ τῆς βίας τῆς γινομένης περὶ τοὺς μελωδοῦντας· ὥς γάρ
 τινος δέονται δυνάμεως εἰς τὸ τὴν ὀξεῖαν ἐκφωνῆσαι, οὕτω καὶ εἰς τὸ τὴν
 βαρεῖαν φθέγασθαι. ἔνθα μὲν γὰρ συνάγουσι τὰ πλευρὰ καὶ τὴν ἀρτηρίαν
 ἐκτείνουσι [διὸ βραχύτερον] βίᾳ ἀποστενοῦντες· ἔνθα δὲ διευρύνουσι τὴν
 (5) ἀρτηρίαν, διὸ βραχύτερον τὸν τράχηλον ποιοῦσι τὸ μήκος τῆς εὐρύτητος
 συναγούσης. ταύτῃ ἔοικεν ἔν τε τοῖς αὐλοῖς εἰς τὸ ἐμπνεῦσαι βίᾳ τῷ
 στενωτέρῳ δυνάμεως δεῖν καὶ εἰς τὸ τῷ εὐρυτέρῳ, ἵνα πληρωθῇ. καὶ
 γὰρ δὴ καὶ μᾶλλον ἐν τοῖς αὐλοῖς· ἀπονώτερον γὰρ τὸ ὀξύ τῷ διὰ τῶν
 ἄνω γίνεσθαι τρημάτων· βίας δὲ δεόμενον τὸ βαρὺ καὶ μείζονος, εἰ δι'
 (10) ὅλου τὸ πνεῦμα πέμποιτο, ὥστε ὅσον μήκους προστίθεται, τοσόνδε καὶ
 πνεύματος ἰσχύος προστίθεται. ἐν δὲ ταῖς χορδαῖς τὸ ἴσον κατὰ θάτε-
 ρον δῆλον· ὅσῳ γὰρ εὐτονωτέρα ἢ τῆς λεπτοτέρας τάσις, τοσῶδε ἢ
 ἀνεῖσθαι δοκοῦσα παχυτέρα· οὕτω τε ὅσῳ ἰσχυρότερος ὁ ἦχος ἐκ τῆς
 λεπτοτέρας, τοσῶδε βαρύτερος ὁ ἕτερος. ἐκ γὰρ μείζονος ὁ πλείων καὶ
 (15) τοῦ πέριξ ἤχος. πῶς γὰρ ἂν σύμφωνοι ἐγίνοντό τινες φθόγγοι, εἰ μὴ
 ἰσότης ἦν; ἀσύγκρατον γὰρ τὸ πλεονάζον. τὸ γὰρ ὑπέρμετρον ὑπὲρ τὴν
 μεῖξιν διάδηλον γίνεται. διὸ τοῖς κατὰ τὴν κρᾶσιν ἰσχυροτέροις τὸ ἀνει-
 μένον πλεῖον ἐπιμείγνυται εἰς τὸ ἰσοδυναμῆσαι· ὥστ' εἰ ἔστι τις συμφω-
 νία, καὶ ἰσότης τῶν ἐξ ὧν γίνεται. εἰ γὰρ ὁ ὀξύς πλείους κινεῖτο ἀριθ-
 (20) μούς, πῶς ἂν συνήχησις γένοιτο; καὶ γὰρ εἰ, ὥς φασιν, καὶ πορρωτέρω
 ἀκούεται ὁ ὀξύτερος φθόγγος τῷ πορρωτέρῳ διὰ τὴν τῆς κινήσεως ὀξύ-
 τητα διικνεῖσθαι ἢ <τῷ> διὰ τὸ πλῆθος γίνεσθαι, οὐκ ἂν ποτε γένοιτο
 σύμφωνος οὗτος πρὸς τὸν βαρύν, οὐθ' ὅτε μόνος ἀκούεται, εἴ γ' ἐν ἀμφο-
 τέροις ἢ συμφωνία, οὐθ' ὅτε ἐκλείπει ὁ βαρύτερος — ἀνάγκη γὰρ κατὰ

1 γενομένης g 4 [διὸ βραχύτερον] del. Düring 6 ταύτῃ ἔοικεν Düring αὐτῇ εἴκειν codd.
 τοιαύτης ἔοικεν Schneider 12 στάσις T 16 ἀσύγκριτον p 18 εἰ om. g 19 κινεῖται p
 22 <τῷ> add. Düring 23 οὗτος Wallis αὐτῇ codd. 24 ὁ βαρύτερος del. Alexanderson

This is clear from the force applied when people sing. For just as they need a certain power to utter a high <note>,²¹⁸ so they do also to utter a low one. In the one case they pull in the ribs and extend the windpipe, narrowing it by force, while in the other they widen the | windpipe, so that they make the throat shorter, since the width contracts the length. In *auloi*, similarly, power is needed to blow forcefully into either a narrower or a wider one, so as to fill it. In fact the case is even clearer in the case of *auloi*, since a high note demands less labour because it comes through the upper holes, and a low note requires greater force, if | the breath is to be sent through the whole <pipe>. Thus however much length is added, the same amount is added to the strength of the breath. In strings the equality on each side is obvious; for by whatever amount the tension of the thinner is tighter, the one that seems to be slacker is thicker by the same amount,²¹⁹ and thus by however much the sound (*ēchos*) from the thinner is stronger, the other is lower to the same extent. For it is from the larger that there comes the greater, | encircling sound (*ēchos*).

How, after all, could some notes be concordant if there were no equality? For what is in excess is unblended, since what is beyond the measure becomes clearly apparent over and above the mixture. Hence with the stronger things in the blend there is mixed more of what is less intense,²²⁰ to equalise their power. Thus if there is a concord, there is also equality between the things from which it arises. For if the high note moved in accordance with more numbers, | how could there be a consonance?²²¹ And if, as people say, the higher note is also heard at a greater distance because it travels further due to the sharpness (*oxytēs*) of its movement, or due to its arising as a consequence of its plurality,²²² then this note would never be concordant with the low note, either when it alone is heard,²²³ given that the concord consists in both of them, or when the lower note is ceasing²²⁴ (since because of | its

²¹⁸ The noun implied is certainly *phōnē*, 'voice', not *phthongos*, 'note', but 'note' is more natural in English.

²¹⁹ *Tasis*, translated as 'tension', often means 'pitch'; *eutonōtera*, translated as 'tighter', can mean (or imply) 'higher'; and *aneisthai* translated as 'to be slacker' often means 'to be lower pitched'. It is puzzling that Theophrastus casts this statement in terms of 'seeming'; I have no explanation to offer.

²²⁰ Literally 'slacker', *aneimenon*; see the previous note.

²²¹ 'Consonance' is a weak attempt to represent *synēchēsis* 'combined sound' (*ēchos*), 'sounding together'. Unlike *symphōnia*, 'concord', it is not a term with a determinate technical meaning regularly used in specialised writings; it is indeed rather rare. Typical uses of the cognate verb *synēchein* appear at 72.25 and 96.4 below, where they refer to the resonances set up in some material by another sound, or to the 'sympathetic' response of one string to another when the latter is struck. Theophrastus' meaning is not entirely clear.

²²² Or without Düring's emendation, 'due to the fact that a plurality arises'.

²²³ That is, before the lower and slower note has arrived at the ear.

²²⁴ I have previously followed Alexanderson in deleting 'the lower note', giving the sense 'or when it [sc. the higher note] is ceasing' (cf. the text printed as fr. 716 in Fortenbaugh *et al.* (1992)). But the MSS reading gives good sense. The lower note travels with less power, and therefore ceases to be perceptible at a point in space where the higher can still be heard.

- (25) τὴν λεληθυῖαν ἔκλειψιν μηκέτ' ἀκούεσθαι — οὐθ' ὅτε μάλιστα ἄμφω ἀκούονται· καὶ τότε γὰρ ὁ ὀξύς σφοδρότερός ἐστιν, ἅτε οἶός τε ὦν καὶ πόρρω διικνεῖσθαι· φθάνει τε οὖν τὸν βαρὺν καὶ κατισχύει, ὥστε σφετερίζεσθαι τὴν αἴσθησιν, αἰεὶ μὴ μειονεκτοῦντος τοῦ βαρυτέρου. ἀλλ' ἐπεὶ ἐστὶ τι σύμφωνον, ἰσότητα δηλοῦν ἀμφοῖν τοῖν φθόγγοις, ἰσότης ἐστὶ
- (30) τῶν δυνάμεων διαφέρουσα τῇ ιδιότητι ἑκατέρᾳ· τὸ γὰρ ὀξύτερον φύσει ὢν ἐκδηλότερον, οὐκ ἰσχυρότερον, πορρωτέρω ἀντιληπτὸν ἐστὶ τοῦ βαρυτέρου, ὥσπερ τὸ λευκὸν ἄλλου τοῦ χρώματος ἢ τι ἕτερον, ὃ οὐχὶ τῷ θάτερον ἥττον εἶναι ὃ πέφυκε μᾶλλον ἀντιληπτὸν ἐστίν, ἢ τῷ μὴ τοῦς
- (64) ἴσους ἀριθμούς κινεῖσθαι, ἀλλὰ τῷ μᾶλλον τῷδε ἢ τῷδε ἐπιβάλλειν τὴν αἴσθησιν διὰ τὴν πρὸς τὰ περίξ ἀνομοιότητα. οὕτως διικνεῖται μὲν καὶ ὁ βαρὺς· ἢ δ' ἀκοή θᾶττον ἀντιλαμβάνεται διὰ τὴν ιδιότητα τοῦ ὀξέος, οὐ διὰ τὸ ἐν αὐτῷ πλήθος. καὶ γὰρ δὴ γε, εἰ καὶ πορρωτέρω ἐκινεῖτο,
- (5) οὐ διὰ τὸ πλείους κινεῖσθαι ἀριθμούς ὁ ὀξύτερος, ἀλλὰ διὰ τὸ σχῆμα, ἐπειδὴ ὁ μὲν ὀξύς ἤχος πρόσω μᾶλλον φέρεται καὶ ἄνω, ὁ δὲ βαρὺς περίξ κατ' ἴσον μᾶλλον.

- Δῆλον δὲ καὶ ἐκ τῶν ὀργάνων· τὰ μὲν γὰρ ὑπὸ κέρας καὶ τὰ σὺν τῷ χαλκῷματι περιηχητικώτερα, ἅτε τοῦ ἤχου ἴσου περὶ πᾶν γινομένου.
- (10) καὶ γὰρ εἴ τις ὀξὺν φθεγγόμενος φθόγγον ἄπτοιο τῆς αὐτοῦ πλευρᾶς, ἔπειτα πάλιν βαρύν, αἰσθάνοιτο ἂν μᾶλλον ἐπὶ τοῦ βαρέος φθόγγου τῇ χειρὶ τῆς περὶ τὴν πλευρὰν κινήσεως. κἂν τοῦ ὀργάνου ἄπτηται τῆς χέλους ἢ τοῦ κέρατος ἢ ἀγκῶνος, ὁπότε τὴν λεπτὴν τύπτοι καὶ τὴν τοῦ βαρέος προετικὴν, πάλιν ἐπαίσθοιτο ἂν μᾶλλον τῆς περὶ τὸ κύτος κινήσεως, ὁπότε τὴν τοῦ βαρυτέρου τύπτοι ἤχου προετικὴν. εἰς πᾶν γὰρ ὁ βαρὺς φθόγγος διικνεῖται περίξ, ὁ δ' ὀξύς πρόσω ἢ εἰς ὃ βιάζεται ὁ φθεγγόμενος. εἰ οὖν ὅσον πρόσω κινεῖται ὁ ὀξύς, τοσόνδε περὶ πᾶν κινεῖτο ὁ βαρὺς, οὐκ ἂν ἐλάττους κινεῖτο ἀριθμούς, ὅπερ κακὰ τῶν αὐλητικῶν δῆλον. ὁ γὰρ μακρότερος αὐλὸς βαρύτερος, ἐν ᾧ πλεῖον τὸ πνεῦμα,
- (20) περὶ ὃ πᾶν ἡ κίνησις. ἀλλ' οὐδὲ τάχει ἂν διαφέρει ὁ ὀξύς· προκατελαμβάνετο γὰρ ἂν τὴν ἀκοήν, ὥστε μὴ γίνεσθαι σύμφωνον· εἰ δὲ γίνε-
ται, ἰσοταχοῦσιν ἄμφω· οὐχὶ οὖν ἀριθμοὶ τινες ἄνισοι τὸν τῶν διαφο-

25 οὐθ' ὅτε Höeg 1934 οὕτε codd. 28 μὴ om. T del. Schneider et Alexanderson μὴν Wallis
29 ἀμφοῖν] αὐτοῖν T 32 τοῦ Alexanderson τοῦ codd. τῷ] τό p 33 τῷ] τό p

1 τῷ] τό p 4 ἐκινεῖτο] ἐξικνεῖτο conl. Wimmer 5 ὁξύτερος del. Sicking 8 τὰ bis Düring
τό codd. 14 ἐπαίσθητο p 22 διαφορῶν m

imperceptible cessation it must no longer be heard), or when both are most clearly heard, for even then the high note is more vigorous, since it is capable of travelling further. Thus it obscures and overpowers the low note, so that it appropriates the perception to itself, even while the lower note is not diminished.²²⁵ But since concordance exists, displaying equality between the two notes, there is equality | in their powers, differing in the peculiar quality (*idiotēs*) of each. For it is by being naturally more conspicuous, not stronger, that what is higher is apprehensible at a greater distance than what is lower, just as is white in relation to any other colour, or anything else that is more apprehensible not because one of the two is less what it is by nature, or because it does not move in accordance with equal numbers, but because perception focuses more on this than on that on account of its unlikeness to the surroundings. Thus the low note travels too, but the hearing apprehends the high note more readily, because of its characteristic quality (*idiotēs*) and not because of the plurality it contains. And indeed, even if the higher note does move to a greater distance, | it is not because it moves in accordance with more numbers but because of its shape, since a high note travels more forwards and upwards, while a low note travels more equally all about.

[64D]

This is clear also from instruments. For those with a horn and those with a bronze attachment are more resonant round about, since the sound (*ēchos*) arises equally all round.²²⁶ | Again, if one were to touch one's own ribs while uttering a high note and then a low note, one would perceive with one's hand the movement around the ribs more in the case of the low note. And if one touches the tortoiseshell or the horn or arm of an instrument, then when one strikes the thin <string> and that which produces a low <note>, one will again feel the movement in the hollow body more | when one strikes the string that produces the lower sound (*ēchos*). For the low note travels everywhere all around, while the high note travels forwards, or in the direction in which the utterer forces it to go. Then if the low note moved all around to the same extent as the high note moves forwards, it would not move in accordance with fewer numbers, as is clear too from matters to do with *auloi*. For a larger *aulos* is lower pitched, and in this there is more breath, | through all of which the movement goes. But neither could a high note be distinguished by its speed; for then it would occupy the hearing first, so that no concord would arise. If it does arise, both are equal in speed. Hence it is not some unequal numbers that give the explanation (*logos*)²²⁷

²²⁵ Schneider and Alexanderson delete the negative in the last clause, giving the sense 'while the lower note is constantly diminishing'. But the argument has more force if the negative is retained.

²²⁶ The horn and the bronze attachment mentioned in this sentence are probably the bells of wind instruments such as the Phrygian (or *elymos*) *aulos*; the horns sometimes used as the arms of stringed instruments are mentioned separately below. On the properties and acoustic effects of horns see especially 71.32–72.34, in Porphyry's quotation from the *De audibilibus*.

²²⁷ *Logos* is unlikely to mean 'ratio' here, since Theophrastus denies that ratios are relevant. But it could mean 'definition', or more broadly, 'account'.

- ρῶν λόγον ποιοῦσιν. αἱ δὲ φύσει τοιαίδε φωναὶ φύσει συνηρμοσμέναι οὔσαι· οὐδὲ γὰρ τὰ διαστήματα, ὥς τινὲς φασιν, αἴτια τῶν διαφορῶν,
- (25) διὸ καὶ ἀρχαί, ἐπειδὴ καὶ τούτων παραλειπομένων αἰ διαφοραί· οὐ γὰρ ὧν παραλειπομένων γίνεται τάδε αἴτια τοῦ εἶναι οὐχ ὥς ποιοῦντα, ἀλλ' ὥς μὴ κωλύοντα. οὐδὲ γὰρ ἡ ἐκμέλεια τῆς ἐμμελείας αἰτία, ἐπειδὴ οὐκ ἂν γένοιτο ἐμμέλεια, εἰ μὴ ἡ ἐκμέλεια παραπέμποιτο, οὐδ' ἂν τι [ἄλλο] ἐπιστημονικὸν γένοιτο, εἰ μὴ τοῦναντίον ἀνεπιστήμον τοῦ ἐπιστή-
- (30) μονος· οὐδὲ γὰρ ὥς ὃν αἴτιον ἀνεπιστήμον τοῦ ἐπιστήμονος, ἀλλὰ παραπεμπόμενον τῷ μὴ κωλύειν, ὥστ' οὐδὲ τὰ διαστήματα τοῦ μέλους αἴτια ὥς ποιοῦντα, ἀλλ' ὥς μὴ κωλύοντα. εἰ γὰρ τις ἅμα φθέγγοιτο
- (65) κατὰ τὸ συνεχὲς καὶ τοὺς μεταξύ τόπους, ἄρ' οὐκ ἐκμελῇ προῖοιτο φωνήν; ὧν οὖν μὴ παραπεμπομένων ἐκμέλεια γίνοιτο ἂν· οὐχὶ τούτων παραλειπομένων ἡ ἐμμέλεια, ὥς εἰ μὴ παραλειφθεῖεν κωλυσόντων.
- Μέγα οὖν ὄφελος τὸ περιῖστασθαι ταῦτα εἰς τὴν μελωδίαν, ὥστ' ἀνευ-
- (5) ρίσκειν τοὺς συνηρμοσμένους πρὸς ἀλλήλους φθόγγους· ἀλλ' οὗτοι μὲν αἴτιοι τοῦ μέλους ὄντες, τὰ δὲ διαστήματα παραπεμπόμενα ἐπιδηλούμενα ἐκμελείας αἰτία ἐστίν, ἧς καὶ ἀρχαὶ λέγοντ' ἂν, οὐχὶ τῆς ἐμμελοῦς φωνῆς. οὐτ' οὖν τὰ διαστήματα αἴτια τῆς ἐμμελείας, ἀλλὰ βλαπτικά

24 διαφορῶν m 25 αἰ — 26 παραλειπομένων om. g 29 [ἄλλο] delevi ἐπιστημονικόν
 et ἀνεπιστήμον τοῦ ἐπιστήμονος del. Sickīng 30 οὐδέ — ἐπιστήμονος om. Mg ἀνεπιστήμον τοῦ
 ἐπιστήμονος del. Sickīng 31 τῷ p

1 οὐκ Sickīng οὖν codd. 4 ταῦτα εἰς τὴν Alexanderson ταύταις τὴν codd. 7 ἧς] οἷς g
 8 οὐτ' ἔτε p

of the differences, but voices with these natural qualities being naturally attuned together.²²⁸

Again, it is not the intervals, as some people say, that are the causes of the differences | and therefore their principles,²²⁹ since even when these are omitted the differences still remain. For if something arises when certain things are omitted, these are not the causes of its existence, not, that is, as producing it, but <only> as not preventing it. For the unmelodic is not a cause of the melodic <merely> because the melodic would not arise if the unmelodic were not eliminated. Nor could there be anything capable of knowing if the opposite of that which knows, that which is ignorant, were not <eliminated>; | for it is not by its existence a cause of that which knows, but, when it is eliminated, by its not preventing it.²³⁰ Thus neither are the intervals the causes of melody as producing it, but as not preventing it. For if someone were at the same time to utter the continuum of the intervening positions as well,²³¹ wouldn't the voice he produced be unmelodic? – not that the melodic arises from these being eliminated, just because they would prevent it if they were not eliminated.

[65D]

Avoiding these things is therefore a great help in melodic singing,²³² so that we can find | the notes that are attuned to one another. But it is the notes that are the causes of the melody, while when the intervals that are excluded are made apparent they are the causes of the unmelodic, whose principles they might be said to be, not those of melodic voice. Thus the intervals are

²²⁸ Literally 'but the voices (that are) by nature (qualitatively) such-like, being by nature attuned together'; that is, a concord occurs when there are two pitched sounds whose intrinsic qualities are so related that they naturally blend into one another.

²²⁹ Or 'origins', *archai*. This paragraph is particularly difficult to interpret, and it is not certain that the theorist against whom it is directed is Aristoxenus, as has usually been thought. For discussion see Barker (2004).

²³⁰ These lines (from 'Nor could there be anything capable of knowing . . .') are appallingly difficult and the text may be corrupt, and in any case I cannot be sure that my translation is correct. Even the words I have rendered as 'capable of knowing', 'that which knows' and 'that which is ignorant' are problematic (I take them to refer to something like features of the mind or soul, as at e.g. *Ar. De an.* 431b). For discussion see Sicking (1998): 130. He tries to cut through the problems by excluding several substantial phrases from the text, and his abbreviated version is certainly more intelligible than what we find in the MSS. But though I myself have suggested the deletion of one word, I do not think that his ruthless editorial strategy is acceptable.

²³¹ That is, if he were to sing not only the notes of a melody, but also all the pitches between them in a continuous glissando, rather like the hapless student whose tribulations are described at 83.25–84.5 below.

²³² At 65.4 I follow the emendation suggested by Alexanderson (involving only the addition of one letter), in which 'these things' (neuter, accusative) are the intervals between the notes of the melody, or more precisely the continuum of pitches that they contain. It makes good sense, though it is open to the objection that the use of the verb περιστάσθαι to mean 'avoid' is not otherwise attested until a later period. If the MSS reading is correct, on the other hand, the sense will be 'It is therefore a great help that melodic singing revolves around these things,' where 'these things' (now feminine, dative) must refer to the melodic and the unmelodic. This too would be consistent with the context. But it is less closely attached to the preceding remarks; the items to which 'these things' would refer have not been mentioned together for ten lines; and the verb, when used in the required sense, nowhere else governs a noun in the dative case. See further Barker (2007): 431–3.

- αὐτῆς φαινόμενά γε, οὐθ' οἱ ἀριθμοὶ αἴτιοι τῷ ποσότητι διαφέρειν ἀλ-
 (10) λήλων τοὺς φθόγγους. κατ' ἄλλο γὰρ ἴσοι εὐρίσκονται οἱ βαρεῖς τοῖς
 ὀξεῖσι καθ' ὃ καὶ ὁ πόνος ἴσος κατὰ τουναντίον· οὐ γὰρ ἦττον τῶν τοὺς
 ὀξεῖς φθόγγους φθεγγομένων οἱ τοὺς βαρεῖς πονοῦσι βιαζόμενοι εἰς
 τουναντίον πάλιν. μία δὲ φύσις τῆς μουσικῆς· κίνησις τῆς ψυχῆς ἢ
 κατ' ἀπόλυσιν γινομένη τῶν διὰ τὰ πάθη κακῶν, ἢ εἰ μὴ ἦν, οὐδ' ἂν
 (15) ἢ τῆς μουσικῆς φύσις ἦν.”

- Τοιαῦτα μὲν τὰ τοῦ Θεοφράστου, πάνυ φυσικώτατα περὶ τῆς κατ'
 ὀξύτητα καὶ βαρύτητα διαφορᾶς αἰτιολογήσαντος καὶ τὰ περὶ τῶν συμ-
 φωνιῶν παραστήσαντος, καὶ ὅλως οὐχ ὥς ἐν ποσότητι φθόγγων ἀλλ'
 ἐν ποιότητι καὶ ιδιότητι κεῖται τὸ μέλος ἐπιδείξαντος, ᾧ χρὴν οἶμαι
 (20) πρότερον ἐλέγξαντα τὸν Πτολεμαῖον οὕτως ἐγχειρεῖν τῷ ζητήματι.

- Εἴρηται δὲ καὶ Παναιτίῳ τῷ νεωτέρῳ ἐν τῷ Περὶ τῶν
 κατὰ γεωμετρίαν καὶ μουσικὴν λόγων καὶ δια-
 στημάτων συντόμως περὶ τούτων μετ' εὐλόγου ἀπολογίας τῆς
 ὑπὲρ τῶν πρεσβυτέρων καὶ διδασκαλίας τῆς κατὰ τοὺς ἀριθμοὺς χρή-
 (25) σεως. γράφει γὰρ ὧδε.

- “Καὶ κατὰ μουσικὴν δὲ τὸ λεγόμενον ἡμιτόνιον κατάχρησις ἐστὶν
 ὀνόματος. ὁ γὰρ οἰόμενος τὸ μεταξὺ διάστημα ὀξέος καὶ βαρέος διχοτο-
 μεῖσθαι μέσῳ τινι φθόγγῳ ὁμοίός ἐστι τῷ τὸ μεταξὺ λευκοῦ καὶ μέλανος
 ἢ θερμοῦ καὶ ψυχροῦ διχοτομεῖσθαι λέγοντι. οὐ γὰρ παρὰ τὰ μεγέθη
 (30) τῶν φθόγγων ἢ περὶ τὰ σύμφωνα πραγματεία, ἀλλὰ παρὰ τὰς ποιότητας.

9 αὐτῆς] αὐτοῖς T 13 κίνησις] κινήσεως p τῆς om. T 14 ἢ Düring ἢ codd. οὐδ' — 15 ἦν
 om. Mg 29 παρὰ] περὶ Alexanderson 30 παρὰ] περὶ ut videtur Alexanderson

not causes of the melodic, but are damaging to it, at least when they are apparent, and neither are the numbers causes, by the notes' differing | from one another in quantity. For in a different respect the low notes are found to be equal to the high ones, according to the way that the labour, too, is equal in opposite respects. For people uttering low notes labour no less than those uttering high ones, but exert their effort in the opposite direction.

The nature of music is one. It is the movement of the soul that occurs in correspondence with its release from the evils due to the emotions; and if it did not exist, neither | would the nature of music.²³³

These are the kinds of thing that Theophrastus said, reasoning about the causes of the difference between high and low pitch, setting out the facts about the concords in a way most appropriate to their nature,²³⁴ and altogether showing that melody does not lie in the notes' quantity but in their characteristic quality.²³⁵ I think that | Ptolemy ought to have critically examined these statements before setting himself to the enquiry in this way.

Panaetius the Younger, in his *On the ratios and intervals in Geometry and Music*, spoke concisely about these matters, giving a well-reasoned defence on behalf of the older writers and instruction on the procedure that is based on numbers.²³⁶ | He writes as follows:

In music the designation 'half-tone' is a misuse of the term. For anyone who thinks that the interval between high and low is divided in half by a note in the middle is like someone who says that the interval between white and black or between hot and cold is divided in half. For the study of concords is not based on | the sizes of the notes but on their qualities.²³⁷ When

²³³ Or 'if it were not this, neither would it be the nature of music'. For discussions of this very difficult fragment (fr. 716 Fortenbaugh), see Barker (1985) and (2007): 413–36, Sicking (1998).

²³⁴ *Physikōtata*, perhaps 'in a way most befitting a natural scientist'.

²³⁵ Here the words *poiōtēs* ('quality') and *idios* ('characteristic attribute') are brought together in a hendiadys.

²³⁶ In calling this Panaetius 'the Younger', Porphyry is probably distinguishing him from the well known Panaetius of Rhodes, head of the Stoa in the later second century BC. The writer of the present passage might possibly be one of his descendants, perhaps his grandson, but we know nothing about him for certain. The title of his work suggests that he was a mathematician, and Porphyry confirms this at 92.20 below.

²³⁷ This is not the mathematical argument commonly used by Pythagoreans and others (e.g. [Eucl.] *Sect. can.* prop. 16) to show that the tone cannot be divided in half. Unlike all other such arguments known to me, the one presented here by Panaetius is based on the thesis, shared with Theophrastus, that the relevant attributes of notes are not quantities but qualities. It does not appear even among the battery of arguments propounded by Adrastus *apud* Theo Smyrn. 70.14–72.20, where he lists four different ways in which the tone can be conceived, and purports to show that the tone can be halved only if it is conceived as an object of pure thought. But Panaetius' strategy has affinities with Adrastus', since he too addresses the issue from more than one perspective; he treats the argument offered here as applying to the tone considered as a relation between audible sounds, and the mathematical argument, recorded at 67.3–5, as applying to the relation between the lengths of string from which the interval is produced on a monochord.

οί δ' ἀπὸ τῶν μαθημάτων ἐπειδὴν λέγωσι τὸ διὰ πασῶν ἐν διπλασίονι λόγῳ, οὐ τοῦτο λέγουσιν, ὅτι τὸ μέγεθος τοῦ φθόγγου τῆς νήτης διπλοῦν ἐστὶ τοῦ μεγέθους τῆς ὑπάτης ἢ ἀνάπαλιν. τεκμήριον δέ, ἐάν τε γάρ

- (66) σφόδρα πλήττωσι τὰς χορδὰς, ἐάν τε τὴν μὲν μᾶλλον, τὴν δ' ἥττον, τὸ μὲν διάστημα ταυτόν, ἡ δὲ μᾶλλον πληττομένη χορδὴ μείζονα ἀποτελεῖ ἤχον, ὥστ' ἔοικεν οὐκ ἐν μεγέθει τὸ διάστημα λέγεσθαι. πῶς οὖν εἴπερ ἐν ποιότησιν ἐστὶ, τὸ μὲν διὰ πασῶν ἐν διπλασίονι λόγῳ λέγεται, τὸ δὲ διὰ τεσσάρων ἐν ἐπιτρίτῳ καὶ τὸ διὰ πέντε ἐν ἡμιολίῳ καὶ τὸ διὰ πασῶν καὶ διὰ πέντε ἐν τριπλασίῳ, τὸ δὲ δις διὰ πασῶν ἐν τετραπλασίονι; ὅτι οὔτε τῆς ὀψεως ἰσχυοῦσης κρίνειν τὰ σύμμετρα τῶν μεγεθῶν ἀλλ' εὐρημένου μέτρου, ὃ καταμετρούμενα τὰ σύμμετρα κρίνεσθαι πέφυκεν, οὔτε τῆς ἀφῆς ἰσχυοῦσης κρίνειν τὴν κατὰ τὰ βάρη σύγκρισιν, ἀλλ' εὐρημένου ζυγοῦ, ὃ κρίνεται τὰ βάρη. ἄτοπον δὲ δοκεῖ τὴν ἀκοὴν πολὺ ἀσθενεστέραν ὑπάρχουσαν τῆς ὀψεως χωρὶς μέτρου τινος καὶ κανόνος κρίνειν τὰ σύμφωνα τῶν διαστημάτων. οἱ γὰρ αὐτὴν αἰσθήσει προσέχοντες ὥς ἐκ γειτόνων φωνῆν ἀκούοντες, ὅμοιοι φαίνονται τοῖς χωρὶς μέτρου διὰ τῆς ὀψεως περὶ τῆς κατὰ τὰ μεγέθη συμμετρίας
- (10) ἀποφαινομένοις, οἱ πολὺ ἀφαμαρτάνουσι τῆς ἀληθείας.
- (15)

Ἦν δὲ πολλὴ ζήτησις ἀνωθεν ἀρξαμένοις τοῖς Πυθαγορείοις καὶ ἐξῆς τοῖς ἀπὸ τῶν μαθημάτων, κατὰ τίνας λόγους ἐπὶ τῶν συμφώνων διαστημάτων ἐκ τῶν διαφερόντων κατὰ ποιότητα φθόγγων μία γίνεται κρᾶσις καὶ τῆς ἐτέρας χορδῆς <μῆ> πληχθείσης, ἢ σύμφωνος συγκινεῖσθαι

32 νήτης Wallis φωνῆς codd.

3 ante πῶς add. ἀπορία T 6 τριπλασίονι Mg 7 ante ὅτι add. λύσις T 9 βάρη] βαρύ T
12 αὐτῇ Mg 15 οἱ πολλοὶ Mp 16 ἦν δὴ] ἡ T ἀνωθεν om. Mg ἀρξάμενοι E 19 <μῆ>
addidi

mathematicians say that the octave is in double ratio, they do not mean that the size of the note *nētē* is double the size of *hypatē*, or vice versa.²³⁸ Evidence of this is that if they strike the strings vigorously, or if they strike one of them more strongly and the other less, the interval is the same, but the string that is struck more strongly produces a louder sound (*ēchos*), and hence the interval is not said to depend on size. Then if indeed it depends on qualities, what is meant by saying that the octave is in double ratio, | the fourth in epitritus, the fifth in hemiolic, the octave plus a fifth in triple, and the double octave in quadruple?²³⁹ Sight does not have the power to judge the proportional relations between sizes, unless some measure²⁴⁰ is found by which the proportional relations are naturally susceptible to being measured and assessed, and neither does the sense of touch have the power to make a discriminating comparison between weights, | unless a balance-beam is found by which the weights are assessed; and it seems absurd to think that hearing, which is much weaker than sight, can assess the concordant relations between intervals without some *kanōn* as a measure.²⁴¹ For those who rely on perception, as if listening to a voice from next door,²⁴² seem like people who make pronouncements about the proportional relations between sizes on the basis of sight without the help of a measure, | and they miss the truth by a long way.

[66D]

There was a great deal of investigation,²⁴³ starting initially with the Pythagoreans and subsequently <continuing> among mathematicians, enquiring in which ratios there arises in the concordant intervals a single blend out of notes differing in quality,²⁴⁴ even when the other of the two strings is not struck, the one which is naturally moved in concordance.²⁴⁵

²³⁸ The note *nētē* is an octave above *hypatē*.

²³⁹ The absence of the octave plus a fourth from this list is significant. See 104.26–105.22 with n. 473 below.

²⁴⁰ As the sequel shows, this ‘measure’ must be a concrete measuring instrument such as a ruler.

²⁴¹ Given the generality of the statement, the *kanōn* here is probably just a ‘ruler’ or ‘measuring-device’, even though the word clearly has the specific sense ‘monochord’ in the next paragraph. Affinities between this passage and Ptol. *Harm.* 5.2–10 may suggest that Ptolemy knew Panaetius’ work.

²⁴² Cf. Plato *Rep.* 531a.

²⁴³ Düring, followed by Alesse, assigns this paragraph and the next to Porphyry himself. I think it more likely, with Theiler and Alexanderson, that it is part of the quotation from Panaetius. It follows naturally from what precedes it, and Porphyry’s subsequent remark at 67.11–12 seems to indicate that he has only just finished presenting the evidence of the earlier writer in favour of his position. Another minor indication is that although what is said about the name *kanōn* at 66.22–3 is consistent with what Porphyry says at 22.10–20 and with the quotation from Ptolemaios that follows at 22.25–30, the way it is expressed is noticeably and perhaps significantly different.

²⁴⁴ Panaetius implies that though the notes differ in quality, they nevertheless ‘arise from’ differences of quantity in the factors that underlie them causally. This corresponds to the position Porphyry approvingly attributes to Aristotle at e.g. 58.10–20 and restates, with an acknowledgement to Panaetius, at 88.2–7.

²⁴⁵ The ‘not’ in this sentence reflects my emendation at 66.19. The MSS reading gives the sense ‘even when one of the two strings is struck, the one which is naturally moved in concordance’; but this seems to miss the point. The allusion is to sympathetic vibration, which is quite often discussed (cf. e.g. [Aristotle] *Probl.* XIX. 24, 42) but rather rarely in connection with the concords; for an example see Theo Smyrn. 50.22–51.4, quoting or paraphrasing Adrastus.

- (20) πέφυκεν. ἐζήτουν εἰ καὶ ταῦτα κατὰ λόγους ἐλαχίστους συμβαίνει. διόπερ ἄλλων κατ' ἄλλας ἐφόδους παρὰ τῶν πρότερον ζητούντων τὸ προκείμενον ἐπὶ τοῦ λεγομένου κανόνος—ὄν ἐγὼ καὶ τοῦνομα οἶμαι ἐσχηκέναι, ἐπεὶ κριτήριόν ἐστι τοῦ κατὰ τὴν ἀκοὴν ἐν τοῖς συμφώνοις γινόμενου πλήθους —εὗρισκον χορδῆς τεταμένης καὶ τοῦ ὑπαγωγέως κατὰ τὴν διχοτομίαν
- (25) ὑπαχθέντος τὴν ὅλην πρὸς τὴν ἡμισεῖαν συμφωνοῦσαν τὸ διὰ πασῶν, ὑπὸ δὲ τὸ τέταρτον ὑπαχθέντος τὴν ὅλην πρὸς τὰ τρία μέρη συμφωνοῦσαν τὴν διὰ τεσσάρων, πρὸς δὲ τὸ τέταρτον τὸ δις διὰ πασῶν· καὶ ὑπὸ τὸ τρίτον τὴν ὅλην πρὸς μὲν τὰ δύο μέρη συμφωνοῦσαν τὸ διὰ πέντε, πρὸς δὲ τὸ τρίτον τὸ διὰ πασῶν καὶ διὰ πέντε· τὸν δὲ τόνον ἐν ἐπογδόῳ,
- (30) ὅτι ἡ ὅλη πρὸς τὰ ὀκτὼ διάστημα ποιεῖ τὸ ἴδιον. διόπερ ἐπειδὴν λέγωσι τὸ διὰ πασῶν ἐν διπλασίονι λόγῳ, οὐ τοῦτο λέγουσιν, ὅτι ὁ φθόγ-
- (67) γος τοῦ φθόγγου διπλάσιος, ἀλλ' ὅτι αἱ χορδαί, ἀφ' ὧν οἱ φθόγγοι οἱ ποιοῦντες τὸ διὰ πασῶν, τοῦτον ἔχουσι τὸν λόγον καὶ ἐπὶ τῶν ἄλλων ὁμοίως. ἐπὶ δ' ἐπογδόου διαστήματος μέσος ἀνάλογον οὐκ ἔστιν ἐν ἀριθμοῖς, οὐδὲ κατὰ τὴν κανονικὴν θεωρίαν τὸν τόνον φασὶ δίχα τέμνε-
- (5) σθαι. διόπερ οὐτ' ἐπὶ τὰς ποιότητας ἀναφερόντων, οὐτ' ἐπὶ τὴν κανονικὴν θεωρίαν τὸ ἡμιτόνιον ἡμισὺ ἐστι τοῦ τόνου, ἀλλὰ καταχρήσει ὀνόματος λέγεται μόνον, καθάπερ ἡμίφωνον καὶ ἡμίονος. οὐδὲ γὰρ ἐν τούτοις ἔνεστι τὸ ἡμισυ τοῦ φωνηέντος ἢ τὸ ἡμισυ τοῦ ὄνου. περὶ μὲν οὖν τοῦ ἐν καταχρήσει λέγεσθαι τὸν διπλασίον τε καὶ τριπλοῦν λόγον ἱκανὰ οἶμαι
- (10) εἶναι τὰ εἰρημένα.”
- Ταῦτα δ' ἡμῖν διὰ πλειόνων μεμήκυνται ἐκ πολλῶν τὸ ἀληθὲς ἐνδείξασθαι σπουδάζουσιν. οὐ γὰρ ὁ τυχὼν ἦν ἀνὴρ, οὐτ' αὐτός, οὐθ' οἱ πρὸ αὐτοῦ τὸν τρόπον τοῦτον ἐνηνεγμένοι· λέγω δ' οἱ τῷ Πτολεμαίῳ ὁμοίως δοξάζοντες, ὧν ἀνατρέπτειν ἐπιχειροῦμεν τὸ δόγμα.
- (15) Ἐπεὶ δ' ὁ Πτολεμαῖος τὰ περὶ τῆς διαφορᾶς τῶν ψόφων οὐ μόνον ἐπέδραμεν, ἀλλὰ καὶ ἐπ' ἥχων καὶ ψόφων τῶν ἐξ ἀψύχων σωμάτων τὰς

20 ἐζήτουν <οὖν> Wifstrand 25 τὸ διὰ πασῶν— 26 συμφωνοῦσαν om. T 30 διάστημα
Wallis διαστήματα mG διαστηματικῇ p 31 τὸν codd. ἐν om. T

| They asked whether these intervals too correspond to the smallest ratios.²⁴⁶ So when different people among our predecessors investigated the matter by different methods with what is called the *kanōn* – which I believe acquired its name because it is the criterion of the plurality presented to the hearing in the concords – they discovered that when a string is stretched and the bridge | is brought under its halfway point, the whole is concordant with the half at the octave; when it is brought under <the point at> a quarter <of the string> the whole is concordant with the three parts at the <interval of a> fourth, and with the quarter at the double octave; when it is under <the point at> a third, the whole is concordant with the two parts at the <interval of a> fifth, and with the one-third part at the octave plus a fifth; and the <interval of a> tone is epogdoic [9:8], | since the whole makes its characteristic interval in relation to the eight parts.²⁴⁷

Thus when they say that the octave is in double ratio, they do not mean that the one note is double the other, but that the strings which produce the notes that form the octave are in this ratio, and so on for the others. In the case of the epogdoic interval there is no mean proportional in numbers, and in the science of *kanonikē* they deny that the tone can be divided in half.²⁴⁸ | Hence neither when people refer to qualities nor in the science of *kanonikē* is the ‘half-tone’ half of a tone, but this expression is only a misuse of the name, just as are ‘semivowel’ [lit. ‘half-vowel’] and ‘half-ass’ [mule]. For in these cases too there is not half of a vowel or half of an ass. So as to the misuse of language in speaking of the double and the triple ratio I think | we have said enough.²⁴⁹

[67D]

We have pursued these matters at length through several <considerations>²⁵⁰ because of our keen ambition to demonstrate the truth from many <pieces of evidence>. For the man [Ptolemy] is not just anybody, neither he himself nor those who introduced this mode of thought before him – I mean those who held similar views to Ptolemy, and whose doctrine we are trying to overturn.

| Now since Ptolemy did not only address the topic of the differences between sounds, but also propounded arguments about the resonances

²⁴⁶ This apparently implies that Panaetius had previously credited the Pythagoreans (or the mathematicians) with attributing small-number ratios to relations between items of some other sort. Perhaps he had discussed them in the part of his work (signalled in its title) that dealt with ratios in geometry.

²⁴⁷ That is, in relation to eight ninths of the whole, sounded when the bridge has been placed under the string one ninth of the way along.

²⁴⁸ See n. 237 above.

²⁴⁹ The special considerations connected with the ‘half-tone’ have of course no bearing on the propriety of speaking of double and triple ratio in the context of the concords. Panaetius is referring to his earlier contention that the ratios are only those of the lengths of strings, and that the relevant attributes of the notes themselves are not quantities but qualities.

²⁵⁰ The implied noun might be ‘arguments’ or ‘testimonies’.

ἀποδείξεις ἐνεστήσατο, Ἀριστοτέλης δὲ τῷ τρόπῳ ἐπεξηλθεν ἐπὶ τῆς καθ' ὁρμὴν προϊέμενης φωνῆς τὴν διδασκαλίαν ποιησάμενος, διείλεται δὲ καὶ περὶ συμφωνιῶν, ἃ χρήσιμα ἔσται πρὸς τὸν μετὰ ταῦτα περὶ αὐτῶν ἐσόμενον λόγον, φέρε καὶ τὰ τούτου συντέμνοντες διὰ τὸ μῆκος ἕνια παρατιθώμεθα, ἵνα καὶ ταύτην πεπληρωκότες ᾶμεν τὴν ἐπαγγελίαν. περὶ δὲ τῶν κατὰ τὰς φωνὰς διαφορῶν ποιούμενος λόγον ἐν τῷ Περὶ ἀκουστῶν φησι.

- (25) “Τὰς δὲ φωνὰς ἀπάσας συμβαίνει γίνεσθαι καὶ τοὺς ψόφους ἢ τῶν σωμάτων ἢ τοῦ ἀέρος πρὸς τὰ σώματα προσπίπτοντος οὐ τῷ τὸν ἀέρα σχηματίζεσθαι, καθάπερ οἶονταί τινες, ἀλλὰ τῷ κινεῖσθαι παραπλησίως αὐτὸν συστελλόμενον καὶ ἐκτεινόμενον καὶ καταλαμβάνομενον, ἔτι δὲ συγκρούοντα διὰ τὰς τοῦ πνεύματος καὶ τῶν χορδῶν γινομένης πληγᾶς. ὅταν γὰρ τὸν ἐφεξῆς ἀέρα πλήξῃ τὸ πνεῦμα τὸ ἐμπίπτον αὐτῷ, ὁ ἀήρ (30) ἤδη φέρεται βίᾳ, τὸν ἐχόμενον αὐτοῦ προωθῶν ὁμοίως, ὥστε ἀντὶ τὴν φωνὴν διατείνειν τὴν αὐτὴν, ἐφ' ὅσον συμβαίνει γίνεσθαι καὶ τοῦ ἀέρος τὴν κίνησιν. διαχεῖται γὰρ ἐπὶ πλεονα ἢ βία τῆς κινήσεως αὐτοῦ γινο-
- (68) μένης, ὥσπερ καὶ τὰ πνεύματα τὰ ἀπὸ τῶν ποταμῶν καὶ ἀπὸ τῆς χώρας ἀποπνέοντα. τῶν δὲ φωνῶν τυφλαὶ μὲν εἰσι καὶ νεφώδεις ὅσαι τυγχάνουσιν αὐτοῦ καταπεπνιγμέναι. λαμπραὶ δ' οὖσαι πόρρω διατείνουσι, καὶ πάντα πληροῦσι τὸν συνεχῆ τόπον. ἀναπνέομεν δὲ τὸν μὲν ἀέρα (5) πάντες τὸν αὐτόν, τὸ δὲ πνεῦμα καὶ τὰς φωνὰς ἐκπέμπομεν ἀλλοίᾳς διὰ τὰς τῶν ὑποκειμένων ἀγγείων διαφοράς, δι' ὧν ἐκάστου τὸ πνεῦμα περαιούται [τὰ] πρὸς τὸν ἕξω τόπον. ταῦτα δ' ἐστὶν ἢ τε ἄρτηρία καὶ ὁ πνεύμων καὶ τὸ στόμα. πλείστην μὲν οὖν διαφορὰν ἀπεργάζονται τῆς φωνῆς αἱ τε τοῦ ἀέρος πληγαὶ καὶ οἱ τοῦ στόματος σχηματισμοί. φανερόν δ' (10) ἐστίν· καὶ γὰρ τῶν φθόγγων αἱ διαφοραὶ πᾶσαι γίνονται διὰ ταύτην τὴν αἰτίαν, καὶ τοὺς αὐτοὺς ὁρῶμεν μιμουμένους καὶ ἵππων φωνὰς καὶ

17 τρόπῳ] τόπῳ g 18 προϊέμενος g 26 παραπλησίως vix sanum, fortasse πεπληγμένον
 31 διατείνει g 32 ἐπιπλέον G
 2 τυγχάνουσαι p 7 [τά] del. Düring

(*ēchē*) and sounds that come from inanimate bodies; and since Aristotle gave an exposition on this theme after presenting his teaching on the voice that is emitted in accordance with an impulse; and since his excursus on the concords, too, will be useful to the discussion of | them that will follow; come, then, let us set down some parts of what he said, abbreviating them because of their length, so that we may have also fulfilled this promise.²⁵¹ When discussing the differences between voices in his *On audible things*, he says this:²⁵²

[800a]²⁵³ All voices and sounds occur when either bodies | collide with bodies or air collides with bodies, not by the air's being shaped, as some people think, but by its being moved nearly equally,²⁵⁴ as it is contracted, expanded and caught up with, and also when it collides <with something else> as a consequence of impacts made by the breath or by strings. For when the breath that impinges on the air strikes the air next to it, the air | is at once forcibly moved, pushing forward the adjacent air in the same way, so that the voice as it extends is the same throughout, for as far as the movement of the air persists. For when its movement happens, the force of the movement is dispersed in many directions, just like the winds that blow from rivers or from the land.²⁵⁵ Those voices that are smothered at their source are muffled and cloudy, while if they are bright they extend further, and fill up the whole of the place continuous with them.

[68D]

We all breathe | the same air, but the breath and the sounds we emit are various because of the differences in the vessels involved, through which each person's breath penetrates to the place outside; these are the windpipe, the lung and the mouth. Both the impacts on the air and the shapings of the mouth produce a great deal of variation. This is evident, | for all differences in notes arise from this cause, and we see the same people imitating the voices

²⁵¹ For the 'promise' see 51.1–3 above.

²⁵² What follows is the treatise known as the *De audibilibus*, or rather, a long fragment of it with some passages omitted, as Porphyry has said. It is known only from this quotation. No modern scholars believe that it is by Aristotle, though it is certainly a product of the early Peripatetic tradition. Various suggestions have been made about the identity of its author. Some scholars have proposed Theophrastus, but there are good reasons for rejecting this view; the likeliest candidate is Strato, who was head of the Lyceum from about 287 to 269 BC. Cf. n. 255 below, and see especially Gortschalk (1968).

²⁵³ I have inserted in the translation the page numbers standardly used in the *Corpus Aristotelicum* as well as those of Düring's edition; but I continue to base my translation on Düring's text except where otherwise stated.

²⁵⁴ The point of the adverb *paraplēsios*, 'roughly equally', is unclear. The suggestion offered in Barker (1989): 99 n. 1, 'in the same way throughout its course', is probably wrong, though a comparable statement appears in the next sentence; I doubt that the word can have this sense. Conceivably it is intended to contradict the notion of 'shaping' which the author has rejected, and means 'without alteration in its form'; but this interpretation too seems strained. I suspect that the text is corrupt, and that the MSS reading conceals something like *peplēgmenon*, 'after having been struck'.

²⁵⁵ Ferrini (2008): 241 notes affinities between this analogy and Strato fr. 88 Wehrli, quoted at Hero Alex. *Pneumatica* I p. 17 Schmidt.

- βατράχων καὶ ἀηδόνων καὶ γεράνων καὶ τῶν ἄλλων ζώων σχεδὸν ἀπάντων, τῷ αὐτῷ χρωμένους πνεύματι καὶ ἀρτηρίᾳ, παρὰ τὸν ἄερα διαφόρως ἐκπέμπειν αὐτοὺς ἐκ τοῦ στόματος. πολλὰ δὲ καὶ τῶν ὀρνέων,
- (15) ὅταν ἀκούσωσι, μιμοῦνται τὰς τῶν ἄλλων φωνὰς διὰ τὴν εἰρημένην αἰτίαν. ὁ δὲ πνεύμων, ὅταν ᾗ μικρὸς καὶ πυκνὸς καὶ σκληρὸς, οὔτε δέχσθαι τὸν ἄερα δύναται πολὺν εἰς αὐτόν, οὔτ' ἐκπέμπειν πάλιν ἔξω, οὐδὲ τὴν πληγὴν ἰσχυράν, οὐδ' εὖρωστον ποιεῖσθαι τὴν τοῦ πνεύματος. διὰ γὰρ τὸ εἶναι σκληρὸς καὶ πυκνὸς καὶ συνδεδεμένος οὐ δύναται λαμβάνειν
- (20) τὴν διαστολὴν ἐπὶ πολὺν τόπον, οὐδὲ πάλιν ἐκ πολλοῦ διαστήματος συνάγων ἑαυτὸν ἐκθλίβειν βίᾳ τὸ πνεῦμα, καθάπερ οὐθ' ἡμεῖς ταῖς φύσiais, ὅταν ὥσι σκληραὶ καὶ μήτε διαστέλλεσθαι, μήτε πιέζεσθαι δύνωνται ῥαδίως· τοῦτο γάρ ἐστι τὸ ποιοῦν τὴν τοῦ πνεύματος πληγὴν εὖρωστον, ὅταν ὁ πνεύμων ἐκ πολλοῦ διαστήματος συνάγων αὐτόν ἐκθλίβῃ
- (25) τὸν ἄερα βιαίως.
- Δῆλον δὲ τοῦτ' ἐστίν· οὐδὲ γὰρ τῶν ἄλλων μορίων οὐθέν ἐκ μικρᾶς ἀποστάσεως δύναται ποιεῖσθαι τὴν πληγὴν ἰσχυράν· οὔτε γὰρ τῷ σκέλει δυνατὸν ἐστίν, οὔτε τῇ χειρὶ πατάξαι σφοδρῶς, οὐδ' ἀπορρῖψαι πόρρω τὸ πληγέν, ἂν μὴ τις αὐτῶν ἐκατέρω ποιήσας ἐκ πολλοῦ λάβῃ τῆς
- (30) πληγῆς τὴν ἀνάτασιν. εἰ δὲ μή, σκληρὰ μὲν ἢ πληγὴ γίνεται διὰ τὴν συντονίαν, ἐκβιάζεσθαι δ' οὐ δύναται πόρρω τὸ πληγέν, ἐπεὶ οὐθ' οἱ καταπέλται μακρὰν δύνανται βάλλειν, οὐθ' ἡ σφενδόνη, οὔτε τόξον, ἂν ἢ σκληρόν καὶ μὴ δύνηται κάμπτεσθαι, μηδὲ τὴν ἀναγωγὴν ἢ νευρὰ λαμβά-
- (69) νειν ἐπὶ πολὺν τόπον. ἂν δὲ μέγας ὁ πνεύμων ἢ καὶ μαλακὸς καὶ εὐτονος, πολὺν τὸν ἄερα δύναται δέχεσθαι, καὶ τοῦτον ἐκπέμπειν πάλιν, ταμιευόμενος ὥς ἂν βούληται διὰ τὴν μαλακότητα καὶ διὰ τὸ ῥαδίως αὐτόν συστέλλειν. ἢ δ' ἀρτηρία μακρὰ μὲν ὅταν ἢ καὶ στενὴ, χαλεπῶς ἐκπέμπουσιν ἔξω τὴν φωνὴν καὶ μετὰ βίας πολλῆς διὰ τὸ μῆκος τῆς τοῦ πνεύματος φορᾶς. φανερόν δ' ἐστίν· πάντα γὰρ τὰ τοὺς τραχήλους ἔχοντα μακροὺς φθέγγονται βιαίως, οἷον οἱ χῆνες καὶ γέραναι καὶ ἀλεκτρυόνες. μᾶλλον δὲ τοῦτο καταφανὲς ἐστίν ἐπὶ τῶν αὐλῶν· πάντες γὰρ χαλεπῶς πληροῦσι τοὺς βόμβυκας καὶ μετὰ συντονίας πολλῆς διὰ τὸ μῆκος τῆς
- (10) ἀποστάσεως. ἔτι δὲ τὸ πνεῦμα διὰ τὴν στενοχωρίαν ὅταν ἐντὸς θλιβόμενον εἰς τὸν ἔξω τόπον ἐκπέσῃ, παραχρῆμα διαχεῖται καὶ σκεδάννυται καθάπερ καὶ τὰ ρεύματα φερόμενα διὰ τῶν εὐρίπων, ὥστε μὴ δύνασθαι

16–17 δέχεσθαι δύναται τὸν ἄερα T 22 δύνονται Mg 27 οὔτε] οὐδέ g 29 αὐτῶν Bekker αὐτόν codd. ποιήσας om. T 30 ἀνάτασιν Düring ἀνάστασιν G ἀπόστασιν ceteri 32 μακρὰ T 33 δύνηται Düring δύναται codd. κάμπτεσθαι] λάμπτεσθαι MG λ mut. in κ G

3 <τις> post βούληται fortasse addendum 8 αὐλῶν Turnebus αὐτῶν codd. 9 βόμβυκας p 11 τόπον om. g

of horses, frogs, nightingales, cranes and just about all other creatures, while using the same breath and the same windpipe, by expelling the air from their mouth in different ways. Many birds too, | when they have heard the voices of others, imitate them by the means we have mentioned.

When the lung is small and dense and hard, it cannot take much air into itself or send much out again, nor can it make the breath's impact strong or robust. For since it is hard and dense and constricted, it cannot admit | much expansion, nor can it draw itself in again from a large distance [800b] and squeeze the breath out with force, just as we cannot with bellows when they are hard and cannot easily be either expanded or compressed. For this is what makes the impact of the breath robust, when the lung draws itself in from a large distance and squeezes | the air out forcefully. This is clear, for none of the other bodily parts can make a strong impact from a short distance. For it is not possible to strike something vigorously with the foot or the hand or to propel the thing struck a long way, unless the person doing this with either of them makes the blow | begin from a great distance.²⁵⁶ Otherwise the impact is hard because of the tension, but cannot drive the thing struck far away, since catapults cannot throw things far, and neither can a sling or a bow, if they are hard and cannot be bent, and if the string cannot be pulled back a long way. But if the lung is large and supple and elastic,²⁵⁷ it can take in a lot of air and expel it again, controlling it however one wishes²⁵⁸ because of its suppleness and because it readily contracts itself.

[69D]

When the windpipe is long and narrow, people expel the voice with difficulty | and with great force, because of the long distance the breath travels. This is evident, for all creatures with long necks, such as geese, cranes and cocks, make their utterances violently.²⁵⁹ It is even clearer in the case of *auloi*, for everyone has difficulty in filling the *bombykes*,²⁶⁰ because of the extent of the | distance. Again, because of the narrowness of the space, when the air which is squeezed inside emerges into the place outside it is immediately dispersed and scattered, like streams passing through narrow ditches, so that the voice cannot be sustained or extend to a great distance.

²⁵⁶ Cf. 54.6–13 above. The literal sense is '... takes the extension of the blow from a great distance'; or instead of 'extension' the noun *anataxis* might here mean 'raising', 'back-lift', though then one would expect 'to' rather than 'from' a great distance. The noun I translate here as 'blow' is the one which in most cases I render as 'impact'.

²⁵⁷ The versatile adjective *eutonos*, literally 'well-tensioned', is used of taut strings that spring back vigorously after being plucked, and sometimes of the high pitch that such a string produces. When used of a person's body or its parts it refers to what we would call 'good muscle-tone'.

²⁵⁸ Literally 'however it wishes'; but lungs do not wish. The author may have been careless, or perhaps the indefinite pronoun *tis* (represented here by 'one') has dropped out of the text.

²⁵⁹ In this passage it sometimes seems more appropriate to translate *bia* as 'force' (the translation used most often elsewhere in the text), and sometimes as 'violence'; the same goes for its cognate adjectives and adverbs.

²⁶⁰ These are probably *auloi* of a particularly long and low-pitched variety, mentioned at Pollux IV.82. Cf. also Aristotle *Metaph.* 1093b and [Eucl.] *Sect. can.* proposition 19. For another interpretation see Hagel (2009): 321 n.139.

- τὴν φωνὴν συμμένειν, μηδὲ διατείνειν ἐπὶ πολὺν τόπον. ἅμα δὲ καὶ
 δυσταμίετον ἀνάγκη πάντων τῶν τοιούτων εἶναι τὸ πνεῦμα καὶ μὴ
 (15) ῥαδίως ὑπηρετεῖν. ὅσων δ' ἐστὶ μέγα τὸ διάστημα τῆς ἀρτηρίας, τῶν
 δὲ τοιούτων ἔξω μὲν περαιοῦσθαι συμβαίνει τὸ πνεῦμα ῥαδίως, ἐντὸς
 δὲ φερόμενον διαχεῖσθαι διὰ τὴν εὐρυχωρίαν, καὶ τὴν φωνὴν γίνεσθαι
 κενὴν καὶ μὴ συνεστῶσαν, ἔτι δὲ μὴ δύνασθαι διαιρεῖσθαι τῷ πνεύματι
 (20) τοὺς τοιούτους διὰ τὸ μὴ συνερεῖδεσθαι τὴν ἀρτηρίαν αὐτῶν. ὅσων δ'
 ἐστὶν ἀνωμάλως καὶ μὴ πάντοθεν ἔχει τὴν διάστασιν ὁμοίαν, τούτους
 ἀναγκαῖον ἀπασῶν μετέχειν τῶν δυσχερειῶν· καὶ γὰρ ἀνωμάλως αὐ-
 τοῖς ἀνάγκη τὸ πνεῦμα ὑπηρετεῖν καὶ θλίβεσθαι καὶ καθ' ἕτερον τόπον
 διαχεῖσθαι πάλιν. βραχείας δὲ τῆς ἀρτηρίας οὕσης ταχύ μὲν ἀνάγκη τὸ
 πνεῦμα ἐκπέμπειν καὶ τὴν πληγὴν ἰσχυροτέραν γίνεσθαι τὴν τοῦ ἀέρος,
 (25) πάντας δὲ τοὺς τοιούτους ὀξύτερον φωνεῖν διὰ τὸ τάχος τῆς τοῦ πνεύμα-
 τος φορᾶς. οὐ μόνον δὲ συμβαίνει τὰς τῶν ἀγγείων διαφοράς, ἀλλὰ καὶ
 τὰ πάθη πάντα τὰς φωνὰς ἀλλοιοῦν· ὅταν μὲν γὰρ ὥσιν ὑγρασίας πλήρη
 πολλῆς ὁ τε πνεύμων καὶ ἡ ἀρτηρία, διασπᾶται τὸ πνεῦμα καὶ οὐ δύνα-
 ται περαιοῦσθαι εἰς τὸν ἔξω τόπον συνεχῶς διὰ τὸ προσκόπτειν καὶ
 (30) γίνεσθαι παχὺν καὶ ὑγρὸν καὶ δυσκίνητον, καθάπερ καὶ περὶ τοὺς κατάρ-
 ρους καὶ τὰς μέθας. ἐὰν δὲ ξηρὸν ᾖ τὸ πνεῦμα παντελῶς, σκληροτέρα
 ἢ φωνὴ γίνεται καὶ διεσπασμένη· συνέχει γὰρ ἡ νοτίς, ὅταν ᾖ λεπτή,
 τὸν ἀέρα καὶ ποιεῖ τινα τῆς φωνῆς ἀπλότητα.

Τῶν μὲν οὖν ἀγγείων διαφοραὶ καὶ τῶν παθῶν τῶν περὶ ταῦτα

- (70) γινομένων τοιαύτας ἕκασται τὰς φωνὰς ἀποτελοῦσιν· αἱ δὲ φωναὶ δο-
 κοῦσι μὲν εἶναι, καθ' οὓς ἂν ἕκασται γίνωνται τόπους, ἀκούομεν δὲ
 πασῶν αὐτῶν, ὅταν ἡμῖν προσπέσωσι πρὸς τὴν ἀκοήν· ὁ γὰρ ὡσθεις
 (5) ὑπὸ τῆς πληγῆς ἄηρ μέχρι μὲν τινος φέρεται συνεχῆς, ἔπειτα κατὰ μι-
 κρὸν ἀεὶ διακινεῖται μᾶλλον, καὶ τούτῳ γινώσκομεν πάντας τοὺς φόφους
 καὶ τοὺς πόρρω γινομένους καὶ τοὺς ἐγγύς. δῆλον δ' ἐστίν. ὅταν γὰρ
 τις λαβὼν κάλαμον ἢ αὐλὸν ἢ σάλπιγγα, προσθεῖς τε ἐτέρῳ πρὸς τὴν

13 συμμένειν] συμβαίνειν T 15 μέγα Bekker μετὰ codd. 18 τῷ πνεύματι] τὸ πνεῦμα conl.
 Alexanderson 34 ante διαφοραὶ add. <αἱ> Bekker ταῦτα Düring τὰ αὐτὰ codd.

1 ἕκασται Bekker ἕκαστα codd. 2 ἕκασται Bekker ἐν ἕκαστῃ codd. 7 κάλαμον scripsi κέραμον
 codd.

At the same time all such creatures' breath is inevitably hard to control and does not | readily obey them.

The breath of people with a large space in the windpipe comes through to the outside easily, but when it is travelling inwards it is dispersed because of the place's width, and the voice becomes hollow and lacks cohesion;²⁶¹ and in addition [801a] such people cannot divide the voice up with their breath because the windpipe is not firmly held together. Those whose | windpipe is uneven and does not have the same width throughout are inevitably subject to all kinds of difficulty; for their breath is bound to obey them unevenly, and must be squeezed and then expanded again in the next place. When the windpipe is short people are bound to expel the breath swiftly, and the impact on the air is stronger, | and all such people must utter at a higher pitch because of the speed with which the breath travels.

But it is not only the differences in the vessels that cause variation in voices, but also all the conditions that affect them. For when the lung and the windpipe are full of a lot of moisture, the breath is dragged in different directions and cannot come through continuously to the place outside, because it hits obstructions and | becomes thick and damp and hard to move, as with people who have catarrh or are drunk. But if the breath is completely dry, the voice becomes harder and fragmented, for when the moisture is slight it holds the air together together, and gives the voice a kind of unity.²⁶²

Thus each of the differences in the vessels and in the conditions that affect them produces voices of sorts like these. Now voices appear to be in the places in which each arises, but we hear all of them when they impinge on our hearing.²⁶³ For the air driven by the impact travels as a coherent whole up to a certain point, and then is gradually | and progressively dispersed; and it is by this that we recognise all sounds, those that arise both far away and nearby. This is obvious, for if one takes a reed²⁶⁴ or an *aulos*²⁶⁵ or a

[70D]

²⁶¹ The thought seems to be that when such people breathe in, the breath spreads out across a wide region and cannot then be projected out again as a coherent mass.

²⁶² Literally 'simplicity (of constitution)', 'singleness'.

²⁶³ It is not always possible to decide whether *akoē* refers to the hearing or to the organ of hearing, but often, as in this case, it makes little difference to the sense.

²⁶⁴ The MSS read *keramon* which means 'a piece of pottery', in this case presumably a pottery tube. But Stefan Hagel has pointed out in conversation that no tubular pottery vessels were familiar in Greek life; and I suggest the emendation *kalamon* 'reed', a word which quite commonly designates a wind instrument (cf. the next note). If the emendation is right the allusion here (as at 119.14–15 below, cf. Hippocr. *De affect. int.* 10.14) must be to a different instrument from the regular *aulos*, but one (unlike the Panpipe *syrtinx*) which is open at both ends (the Hippocratic passage implies as much, saying that the breath passes *through* the *kalamos*). Presumably it is the one called the *monokalamos syrtinx* or *monaulos* (see e.g. Ath. 148a, 174c–176e, Pollux 4.75, Longus 1.4.3).

²⁶⁵ The noun *aulos* can refer to any kind of tube, but in this context the instrument is probably meant. If both that and the emendation mentioned in the previous note are correct, all three items on the list are musical instruments (that they should be so is suggested, though not guaranteed, by the use of the word *organon*, 'instrument' but not in all contexts 'musical instrument', at 70.10).

- ἀκοήν, διὰ τούτων λαλή, πᾶσαι δοκοῦσιν αἱ φωναὶ παντελῶς εἶναι πλη-
 σίον τῆς ἀκοῆς διὰ τὸ μὴ σκεδάννυσθαι τὸν ἀέρα φερόμενον, ἀλλὰ διατη-
 (10) ρεῖσθαι τὴν φωνὴν ὁμοίαν ὑπὸ τοῦ περιέχοντος ὀργάνου. καθάπερ οὖν
 καὶ ἐπὶ τῆς γραφῆς, ὅταν τις τοῖς χρώμασι τὸ μὲν ὅμοιον ποιήσῃ τῷ
 πόρρω, τόδε τῷ πλησίον, τὸ μὲν ἡμῖν ἀνακεχωρηκέναι δοκεῖ τῆς γραφῆς,
 τὸ δὲ προέχειν, ἀμφοτέρων αὐτῶν ὄντων ἐπὶ τῆς αὐτῆς ἐπιφανείας, οὕτω
 καὶ ἐπὶ τῶν ψόφων καὶ τῆς φωνῆς· ὅταν γὰρ ἡ μὲν ἤδη διαλελυμένη
 (15) προσπίπτῃ πρὸς τὴν ἀκοήν, ἡ δὲ τις συνεχῆς, ἀμφοτέρων αὐτῶν ἀφικνου-
 μένων πρὸς τὸν αὐτὸν τόπον, ἡ μὲν ἀφεστηκέναι πόρρω δοκεῖ τῆς ἀκοῆς,
 ἡ δ' εἶναι σύνεγγυς, διὰ τὸ τὴν μὲν τῇ πόρρωθεν ὁμοίαν εἶναι, τὴν δὲ
 πλησίον.
- Σαφεῖς δὲ μάλιστα αἱ φωναὶ γίνονται παρὰ τὴν ἀκρίβειαν τὴν τῶν
 (20) φθόγγων· ἀδύνατον γὰρ μὴ τελέως τούτων διηρθρωμένων τὰς φωνὰς
 εἶναι σαφεῖς, καθάπερ καὶ τὰς τῶν δακτυλίων σφραγίδας, ὅταν μὴ δια-
 τυπωθῶσιν ἀκριβῶς. διόπερ οὔτε τὰ παιδία δύνανται διαλέγεσθαι σα-
 φῶς, οὐθ' οἱ μεθύοντες, οὐθ' οἱ γέροντες, οὐθ' ὅσοι φύσει τραυλοὶ τυγ-
 χάνουσιν ὄντες, οὐθ' ὅλως ὁσων εἰσὶν αἱ γλῶτται καὶ τὰ στόματα δυ-
 (25) σκίνητα· ὥσπερ γὰρ καὶ τὰ χαλκία καὶ τὰ κέρατα συνηχοῦντα ποιεῖ τοὺς
 ἀπὸ τῶν ὀργάνων φθόγγους ἀσαφεστέρους, οὕτω καὶ ἐπὶ τῆς διαλέκτου
 πολλὴν ἀσάφειαν ἀπεργάζεται τὰ ἐκπίπτοντα τῶν πνευμάτων ἐκ τοῦ
 στόματος, ὅταν μὴ διατυπωθῶσιν ὁμοίως. οὐ μόνον δ' ἑαυτῶν τινὰ παρεμ-
 φαίνουσιν ἀσάφειαν, ἀλλὰ καὶ τοὺς διηρθρωμένους τῶν φθόγγων ἐμπο-
 (30) δίξουσιν, ἀνομοίας αὐτῶν γινομένης τῆς περὶ τὴν ἀκοήν κινήσεως· διό
 καὶ μᾶλλον ἐνὸς ἀκούοντες συνίμεν ἢ πολλῶν ἅμα ταῦτά λεγόντων, κα-
 θάπερ καὶ ἐπὶ τῶν χορδῶν, καὶ πολὺ ἥττον, ὅταν προσαυλῇ τις ἅμα καὶ
 κιθαρίζῃ, διὰ τὸ συγχεῖσθαι τὰς φωνὰς ὑπὸ τῶν ἐτέρων. οὐχ ἥκιστα

10 οὖν om. G 13 προέχειν Bekker περιέχειν codd. 14 γάρ om. T 17 μὲν τῇ Wallis μέντοι
 codd. 19 τὴν^{sec.} om. g 25 χαλκεῖα MTg 26 ἀσαφεστέρους Wallis σαφεστέρους codd.
 27 ἐκ τοῦ στόματος om. Mg 28 δ' om. G ἑαυτῶν T ἑαυτῷ ceteri 33 συγχεῖσθαι Wifstrand
 συγχεῖσθαι codd.

salpinx and talks through it after placing it against another person's ear, all the vocal sounds seem to be very close to the ear because the travelling air is not scattered, but | the voice is preserved in the same state by the instrument that contains it. Thus just as in painting, when someone uses colours to make one thing resemble what is far away and another resemble what is nearby, one of them seems to us to recede from the painting and the other to stand forward, though both of them are on the same surface, so it is too with sounds and the voice. For when one voice | strikes the ear when it is already dispersed, and the other is a coherent whole, then even though both arrive at the same place, the former seems to be far away from the ear and the latter to be close by, because the one resembles a [801b] distant voice and the other a voice nearby.

Voices are clear in proportion, above all, to the precision | of the notes,²⁶⁶ for if these are not perfectly articulated it is impossible for the voices to be clear, just as with the seals on rings when they are not precisely engraved. That is why children cannot speak clearly, and neither can those who are drunk or old, or who have an inborn speech-impediment, or in general those whose tongues and mouths are difficult | to move. For just as pieces of bronze or horns, when they resonate, make the notes from the instruments less clear,²⁶⁷ so too in the case of speech the impulses of breath emitted from the mouth create serious lack of clarity when they are not evenly formed.²⁶⁸ Not only do they display their own lack of clarity, but they also impede the notes that are perfectly articulated, | since their movement in the region of the ear is uneven. This is why we understand better when we hear one person than when we hear many people saying the same thing at once, just as happens also with strings, and <we distinguish the sounds> much less well when someone plays the *aulos* at the same time as <someone plays> the kithara, because the voices are confused by the others.²⁶⁹ This

²⁶⁶ The word 'notes' may seem inappropriate here and in some other contexts in the *De audibilibus*. I use it partly for the sake of consistency in my rendering of *phthonggos*, for which it is usually the right translation, and partly because pitch may not be altogether irrelevant to this argument; perfect pronunciation of the Greek language involved giving each word the right pitch-contours as well as forming the syllables correctly.

²⁶⁷ Here I follow Wallis and Prantl in reading *asaphesterous*, 'less clear', for the MSS *saphesterous*, 'clearer'; it seems essential to the comparison ('just as . . . so too'). The sense of the MSS reading is probably the one we would expect, and would be unproblematic if the remark occurred in isolation, but any attempt to fit it into the context is bound, I think, to be implausibly tortuous. Cf. also 71.32–72.1 below. The reference in the present passage is clearly to the horns or bronze bells fitted to instruments as resonators. Whether they are still being treated in this way in the long passage on horns at 71.32–72.34 and in certain allusions elsewhere in the text is a question calling for separate discussion; see n. 275 below.

²⁶⁸ The verb I translate here as 'formed' (*diatypōthōsin*) is the same as the one translated as 'engraved' at 70.21–2, and the close parallel between 'not evenly formed' and 'not precisely engraved' encourages us to interpret 'not evenly' in the light of the analogy of the seal. It has, as it were, rough edges, so that the smooth profile proper to the syllable being articulated is imperfectly preserved.

²⁶⁹ I.e. the 'voices' or sounds of the one instrument are obscured by those of the other.

- (71) δὲ τοῦτο ἐπὶ τῶν συμφωνιῶν φανερόν ἐστιν· ἀμφοτέρους γὰρ ἀποκρύπτεσθαι τοὺς ἦχους συμβαίνει ὑπ' ἀλλήλων.
- Ἄσαφεῖς μὲν οὖν φωναὶ γίνονται διὰ τὰς εἰρημένους αἰτίας. λαμπραὶ δὲ γίνονται καθάπερ ἐπὶ τῶν χρωμάτων· καὶ γὰρ ἐκεῖ τὰ μάλιστα
- (5) δυνάμενα τὰς ὄψεις κινεῖν, ταῦτα εἶναι συμβαίνει τῶν χρωμάτων λαμπρότατα. τὸν αὐτὸν τρόπον τῶν φωνῶν ταύτας ὑποληπτέον εἶναι λαμπρότητας, ὅσαι μάλιστα δύνανται προσπίπτουσαι κινεῖν τὴν ἀκοήν τοιαῦται δ' εἰσὶν αἱ σαφεῖς καὶ πυκναὶ καὶ καθαραὶ καὶ πόρρω δυνάμεναι διατείνειν· καὶ γὰρ ἐν τοῖς ἄλλοις αἰσθητοῖς ἅπασιν τὰ ἰσχυρότερα καὶ
- (10) πυκνότερα καὶ καθαρώτερα σαφεστέρας ποιεῖ τὰς αἰσθήσεις. δηλὸν δὲ τὸ γὰρ τελευταῖον αἱ φωναὶ πᾶσαι γίνονται κωφαί, τοῦ ἄερος ἤδη διαχεομένου. δηλὸν δ' ἐστὶ κατὰ τῶν αὐλῶν· τὰ γὰρ ἔχοντα τῶν ζευγῶν τὰς γλῶσσας πλαγίας μαλακωτέραν μὲν ἀποδίδωσι τὴν φωνήν, οὐχ ὁμοίως δὲ λαμπράν· τὸ γὰρ πνεῦμα φερόμενον εὐθέως εἰς εὐρυχωρίαν
- (15) ἐμπίπτει, καὶ οὐκέτι φέρεται σύντονον, οὐδὲ συνεστηκός, ἀλλὰ διεσκειδασμένον. ἐν δὲ ταῖς συγκροτωτέραις γλώτταις ἡ φωνὴ γίνεται σκληρότερα καὶ λαμπροτέρα, ἂν πίεση τις αὐτὰς μᾶλλον τοῖς χεῖλεσι, διὰ τὸ φέρεσθαι τὸ πνεῦμα βιαιότερον.
- Αἱ μὲν οὖν λαμπραὶ τῶν φωνῶν γίνονται διὰ τὰς εἰρημένους αἰτίας·
- (20) παρ' ὃ καὶ δοκοῦσιν οὐ χεῖρους εἶναι τῶν λευκῶν αἱ καλούμεναι φαιαί· πρὸς γὰρ τὰ πάθη καὶ τὰς πρεσβυτέρας ἡλικίας μᾶλλον ἀρμόττουσιν αἱ τραχύτεραι καὶ μικρὸν ὑποσυγκεχυμένοι καὶ μὴ λίαν ἔχουσαι τὸ λαμπρὸν ἐκφανές. ἅμα δὲ καὶ διὰ τὴν συντονίαν οὐχ ὁμοίως εἰσὶν εὐπειθεῖς· τὸ γὰρ βίᾳ φερόμενον δυσσταμίετον· οὔτε γὰρ ἐπιτεῖναι ῥᾶδιον, ὥς

2 συμβαίνειν τοὺς ἦχους T 7 κινεῖν] λυπεῖν G λιπεῖν p 8 διατείνειν] διατενεῖν Mp διατεμεῖν G 10 δηλὸν δὲ Bekker δηλοῖ δὲ codd. 12 ζευγῶν scripsi δευτέρων codd. 16 συγκροτωτέραις Prantl συγκροτητικαῖς Düring συγκροτέραις codd. σκληροτέραις Wallis et Bekker 22 ἀποσυγκεχυμένοι g 23 ἐμφανές Mg ἀπειθεῖς g

is particularly evident in the case of the concords, for each of the sounds [71D] (*ēchoi*) is concealed by the other.

Voices are thus less clear for the reasons mentioned. They are bright for the same reason as colours, for in their case the ones that are most | able to move the eye-sight are the brightest of the colours. In the same way the voices that must be reckoned the brightest are those most able to move the hearing when they impinge on it. These are the voices that are clear, dense and pure, and are capable of extending to a distance; for in all other perceptible things too the stronger and | denser and purer make our perceptions clearer. This is obvious; for in the end all voices become silent as soon as the air becomes dispersed. It is obvious, too, in the case of *auloi*; for those of the reeds²⁷⁰ which have oblique tongues give out a softer voice but one that is less bright. For the breath travels directly into a wide space, | and is no longer under tension or compressed as it travels, but is scattered. But with tongues that beat more closely together,²⁷¹ the voice becomes harder and brighter if one presses on them more firmly with the lips, because the breath travels more forcefully.

Bright voices are so, then, [802a] for the reasons mentioned. | In this connection it appears that what are called 'grey' voices are no worse than 'white' ones,²⁷² for rougher voices that are a little confused and do not have too much conspicuous brightness are more suited to the emotions,²⁷³ and to the later times of life; and at the same time they [bright sounds] are not so easy to control, because of their intensity, for what travels forcefully is hard to manage. Nor is it easy to tense | or relax them as one wishes.²⁷⁴ The voices of *auloi* and other instruments are bright when the breath that

²⁷⁰ At 71.12 I read *tōn zeugōn* 'the reed mouthpieces' for the MSS *tōn deuterōn*, 'the second <ones>', which is unintelligible by itself. Another possibility is *tōn deuterōn* <*zeugōn*>, 'the second kind of reed mouthpieces', which would have to be understood as a reference to the later of the two types of reed described by Theophrastus at *Hist. plant.* IV.11.4–6 (this possibility is mentioned in Düring (1934): 171 n. 3). But it seems an intolerably compressed way of making the allusion. The use of the noun *zeugos*, literally 'yoke', to refer to the mouthpiece of the *aulos* is well attested; cf. e.g. 73.2, 75.31 below.

²⁷¹ The text is again in doubt. The MSS have *syngkroterais*, which seems improbable; neither this adjective nor the one from which it is formed, if it is a comparative, is used elsewhere, and it is not a very plausible formation. Düring emends to *syngkrotētikais*; I follow Prantl in reading *syngkrotōterais*. These adjectives too appear nowhere else in Greek literature, but their forms are more convincing than the MSS reading. Whichever choice is made the general sense will be similar, but there is one important difference. If the adjective is a comparative, as with Prantl's reading and perhaps also the MSS, the implication will be that the 'oblique tongues' at 71.13 beat less closely together; and in that case both kinds of mouthpiece will be double reeds, akin to those of the modern oboe (they are repeatedly represented in Greek vase-paintings). If it is not, the opposite conclusion must be drawn; the 'oblique tongues' are those of 'single' or 'beating' reeds like those of a modern clarinet. I incline, tentatively, to the former view. I interpret the passage of Theophrastus mentioned in the previous note in the same way, but it is subject to similar uncertainties.

²⁷² Compare Aristotle *Topics* 106a–107a. Aristotle was apparently unaware of this use of the adjective 'grey'; perhaps it was peculiar to the jargon of musicians.

²⁷³ For other passages connecting timbre with emotion see Ferrini (2008): 260 n. 101.

²⁷⁴ Here, as often, 'tensing' and 'relaxing' refer to raising or lowering the pitch.

- (25) βούλεται τις, οὐτ' ἀνιέναι. ἐπὶ δὲ τῶν αὐλῶν γίνονται αἱ φωναὶ λαμπραί, καὶ τῶν ἄλλων ὀργάνων, ὅταν τὸ ἐκπίπτον πνεῦμα πυκνὸν ἢ καὶ σύντονον· ἀνάγκη γὰρ καὶ τοῦ ἔξωθεν ἀέρος τοιαύτας γίνεσθαι τὰς πληγὰς, καὶ μάλιστα τὰς φωνὰς οὕτω διαπέμπεσθαι συνεστῶσας πρὸς τὴν ἀκοήν, ὥσπερ καὶ τὰς ὁσμάς καὶ τὸ φῶς καὶ τὰς θερμότητας. καὶ γὰρ πάντα
- (30) ταῦτα ἀραιότερα φαινόμενα πρὸς τὴν αἴσθησιν ἀσημότερα γίνεται, καθάπερ καὶ οἱ χυλοὶ κραθέντες τῷ ὕδατι καὶ ἐτέροις χυλοῖς. τὸ γὰρ ἑαυτοῦ παρέχον αἴσθησιν ἀσαφεῖς ἐκάστω ποιεῖ τὰς δυνάμεις. ἀπὸ δὲ τῶν ἄλλων ὀργάνων οἱ τῶν κεράτων ἤχοι πυκνοὶ καὶ συνεχεῖς πρὸς τὸν ἀέρα
- (72) προσπίπτοντες ποιοῦσι τὰς φωνὰς ἀμαυράς· διὸ δεῖ τὸ κέρας τὴν φύσιν ἔχειν τῆς αὐξήσεως ὁμαλὴν καὶ λείαν καὶ μὴ ταχέως ἐκδεδραμηκυῖαν· ἀνάγκη γὰρ μαλακώτερα καὶ χαυνότερα γίνεσθαι τὰ τοιαῦτα τῶν κεράτων, ὥστε τοὺς ἤχους διασπᾶσθαι καὶ μὴ συνεχεῖς ἐκπίπτειν δι' αὐτῶν,
- (5) μηδὲ γεγωνεῖν ὁμοίως διὰ τὴν μαλακότητα καὶ τὴν ἀραιότητα τῶν πόρων, μηδὲ πάλιν εἶναι δυσσαυξῆ τὴν φύσιν, μηδὲ τὴν σύμφυσιν ἔχειν πυκνὴν καὶ σκληρὰν καὶ δύσφορον· καθ' ὃ τι γὰρ ἂν προκόψη φερόμενος ὁ ἤχος, αὐτοῦ λαμβάνει τὴν κατάπαυσιν καὶ οὐκέτι περαιοῦται πρὸς τὸν ἕξω τόπον, ὥστε κωφούς καὶ ἀνωμάλους ἐκπίπτειν τοὺς ἤχους
- (10) ἐκ τῶν τοιούτων κεράτων. ὅτι δ' ἡ φορά γίνεται κατὰ τὴν εὐθυπορίαν, φανερόν ἐστιν ἐπὶ τῶν ἰστῶν, καὶ ὅλως ἐπὶ τῶν ξύλων τῶν μεγάλων, ὅταν αὐτὰ βασανίζωσιν· ὅταν γὰρ κρούσωσιν ἐκ τοῦ ἐτέρου ἄκρου κατὰ

28 οὕτω] οὕτε g

29 ὁσμάς g

33 πυκνοὶ καὶ] πυκναὶ T

I πίπτοντες G

emerges is dense and under tension, for then the impacts on the external air will necessarily have the same qualities, and the voices will be transmitted to the ear in a very compact condition, as is also the case with smells and light and heat. For all | these are less noticeable to the senses when they seem more diffuse, as are flavours when they are mixed with water or with other flavours. For anything that presents a sensation of itself makes the powers of each other thing unclear.

But by contrast with the other instruments, if the resonances (*ēchoi*) of horns are dense and continuous when they impinge on the air, they make the voices dim.²⁷⁵ The horn's natural growth should therefore be even and smooth, and it should not have sprung up quickly – for such horns are bound to be softer and more porous, so that their resonances²⁷⁶ are dispersed and lack coherence when they emerge from them, | and they do not ring out in the same way because of the softness and diffuseness of the pores – nor, on the other hand, should their natural growth be retarded, nor should their natural constitution be dense and hard and rigid. For wherever the resonance strikes an obstruction as it travels, it is arrested there and no longer passes through to the outside, so that the resonances emerging from horns of this sort | are muffled and uneven. The fact that the movement is in a straight line is clear from the example of masts, and large pieces of timber in general, when people test them; for when they tap them at one end

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²⁷⁵ The sentence is extremely problematic; on any reading of it the Greek is awkward. My translation assumes that these horns, like the ones mentioned at 70.25, are attached to other instruments and are not independent instruments themselves (cf. also 76.8–10); the resonances (*ēchoi*) occur in the material of the horns, as the rest of this passage makes clear, and the 'voices' (*phōnai*) are those of the instruments to which they are fixed. I had previously supposed that the sentence meant: 'If the resonances of horns are dense and continuous when they impinge on the air, they make the voices coming from other instruments dim.' This would make the assumption I have mentioned explicit, but I now think that it strains the text too far, since it requires us to treat the arrangement of clauses in the text as radically misleading. On the interpretation I now give it, the assumption seems justified partly because of the parallel at 70.25, and partly because it would otherwise be odd to choose horns as the leading example of an instrument in this context and to devote so long a passage to them (down to 72.34); they were rarely used as independent instruments in the Greek world, and even then only as signalling devices. The statement that the 'voices' are made dim when the resonances are dense and continuous may seem strange, just as it seems strange at 70.25–6, if the emendation is correct, that in similar circumstances the notes are 'less clear'. On my interpretation, the writer indicates his recognition of this apparent strangeness in the phrase 'by contrast with the other instruments' (for uses of *apo* in roughly the required sense see LSJ s.v. ἀπό I.2–3, and for a similar interpretation see Ferrini (2008): 221). I take it that as in the other examples mentioned in the earlier passage, each of the sounds, the 'resonance' and the 'voice' or 'note', is conceived as interfering with and obscuring the other. If the author meant, as we might have expected, that dense and continuous resonances always make the 'voices' or 'notes' clear and bright, the MSS reading at 70.25 can be kept (but with attendant difficulties; see n. 267 above); but *amauras*, 'dim', at 72.1 must now be emended instead, to give the opposite sense. On that interpretation the writer must have abandoned the topic of 'grey' and 'mingled' sounds, and reverted to the subject of bright ones.

²⁷⁶ In this passage (down to 73.10) I translate *ēchos* consistently as 'resonance'; it seems to be distinguished systematically from *phōnē*, which I take to refer to the principal sound or 'voice' of the instrument.

- τὸ ἕτερον, ὁ ἦχος φέρεται συνεχῆς, ἐὰν μὴ τι ἔχη σύντριμμα τὸ ξύλον·
 εἰ δὲ μή, μέχρι τούτου προελθὼν αὐτοῦ καταπαύεται διασπασθεῖς. περι-
 (15) κάμπτει δὲ καὶ τοὺς ὄζους, καὶ οὐ δυνατὸς δι' αὐτῶν εὐθυπορεῖν. κατὰ-
 δηλον δὲ τοῦτ' ἐστὶ καὶ ἐπὶ τῶν χαλκείων, ὅταν ῥινῶσι τὰς ἀπηρτη-
 μένας στολίδας τῶν ἀνδριάντων, ἢ τὰ πτερύγια, †τῷ συμμύειν†· διὸ ῥοῖ-
 ζον καὶ πολὺν ἦχον ἀφιδάσι καὶ ψόφον. ἂν δὲ τις αὐτὰ ταινία διαδῇση,
 παύεσθαι συμβαίνει τὸν ἦχον· ἕως γὰρ τούτου προελθὼν ὁ τρόμος, ὅταν
 (20) προσκόψῃ πρὸς τὸ μαλακόν, αὐτοῦ ποιεῖται τὴν κατάπαυσιν.
 Πολὺ δὲ καὶ ἡ ὀπτήσις ἢ τῶν κεράτων συμβάλλεται καὶ πρὸς εὐφω-
 νίαν· μᾶλλον μὲν γὰρ κατοπτηθέντα παραπλήσιον τὸν ἦχον ἔχουσι τῷ
 κεράμῳ διὰ τὴν σκληρότητα καὶ τὴν σύγκαυσιν· ἐὰν δὲ τις αὐτὰ κατα-
 δεέστερον ὀπτῇσῃ, ἀπαλώτερον μὲν ἀφίησι διὰ τὴν μαλακότητα τὸν ἦχον,
 (25) οὐ δύναται δὲ γεγωνεῖν ὁμοίως. διὸ καὶ τὰς ἡλικίας ἐκλέγονται· τὰ
 μὲν γὰρ τῶν γερόντων ἐστὶ ξηρὰ καὶ πεπωρωμένα καὶ χαῦνα, τὰ δὲ τῶν
 νέων ἀπαλὰ παντελῶς καὶ πολλὴν ἔχοντα ἐν αὐτοῖς ὑγρασίαν. δεῖ δ'
 εἶναι, καθάπερ εἴρηται, τὸ κέρας ξηρόν καὶ πυκνὸν ὁμαλῶς καὶ εὐθύπο-
 ρον καὶ λεῖον· οὕτω γὰρ ἂν μάλιστα συμβαίνοι καὶ τοὺς ἦχους πυκνοὺς
 (30) καὶ λείους καὶ ὁμαλοὺς φέρεσθαι δι' αὐτῶν, καὶ τοῦ ἕξωθεν ἀέρος τὰς
 πληγὰς γίνεσθαι τοιαύτας, ἐπεὶ καὶ τῶν χορδῶν εἰσιν αἱ λειόταται βέλτι-
 σται καὶ τοῖς πᾶσιν ὁμαλώταται, καὶ τὴν κατεργασίαν ἔχουσι πάντοθεν
 ὁμοίαν, καὶ τὰς συμβολὰς ἀδήλους τὰς τῶν νεύρων· οὕτω γὰρ συμβαί-
 νει καὶ ταύτας ποιεῖσθαι τὰς τοῦ ἀέρος πληγὰς ὁμοιοτάτας.
 (35) Δεῖ δὲ καὶ τῶν αὐλῶν εἶναι τὰς γλώττας πυκνάς καὶ λείας καὶ ὁμα-
 (73) λὰς, ὅπως ἂν καὶ τὸ πνεῦμα διαπορεύηται δι' αὐτῶν λεῖον καὶ ὁμαλὸν
 καὶ μὴ διεσπασμένον· διὸ καὶ τὰ βεβρεγμένα τῶν ζευγῶν καὶ τὰ πεπω-
 κότα τὸ σίαλον εὐφωνότερα γίνεται, τὰ δὲ ξηρὰ κακόφωνα· ὁ γὰρ ἄηρ

14 προελθὼν Düring προσελθὼν codd. καταπαύσεται p 17 τῷ συμμύειν vix sanum

20 προσκόψῃ mp 21 πολὺ] πολλή g 26 πεπωρωμένα p

30 καὶ ὁμαλοὺς om. g

2 πεπτωκότα p

in the direction of the other, the resonance travels continuously,²⁷⁷ unless the timber has a crack, in which case it advances to that point and then is dispersed and ceases. | It also bends around the knots, and is unable to travel straight through them. This is clear also in the case of bronze objects, when people file the trailing robes of statues, or the folds;²⁷⁸ that is why they emit a whistling sound, and a great deal of resonance and noise. But if one ties a rope round them, the resonance stops, for the vibration advances up to this point, but when | it meets something soft it comes to [802b] a halt there.

Baking the horns contributes a lot to the pleasantness of the voice. For those that have been baked more have a resonance like that of pottery,²⁷⁹ because of the hardness and dryness caused by firing; but if one bakes them too little, they emit a gentler resonance because of their softness, | but cannot ring out so well. This is why people select <horns of> specific ages, for those of old animals are dry and hardened and loose grained, while those of young ones are very pliable and contain a great deal of moisture. As we have said, the horn should be dry, even in density, smooth and with straight pores,²⁸⁰ since under these conditions most of all, the resonances travelling through it will also be dense, | smooth and even, and so will their impacts on the air; for the best strings, too, are the smoothest and most even in every part; their construction is the same throughout, and the junctions of the strands²⁸¹ are hard to discern. For in this way they too make impacts on the air which are most similar to one another.

| The tongues of *auloi* should be dense, smooth and even, so that the breath may travel through them in a smooth and even condition and is not dispersed. This is why reeds²⁸² that have been moistened and those that have absorbed saliva have a pleasanter voice, while the voice of dry ones

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²⁷⁷ This interpretation of the sentence is due to Massimo Raffa, who has pointed out to me (correctly) that the sentence structure does not support my earlier reading: 'when they tap them at one end the resonance travels continuously to the other . . .'

²⁷⁸ After 'folds' the MSS add *tai symmuein*, which should mean 'by closing'. The paraphrase I offered in my earlier translation (Barker (1989): 104), 'to close up the slits', is impossible. The dative construction can hardly sustain the sense 'in order to . . .'. More importantly, the verb *symmuein*, 'to close', which is common in Peripatetic writings in zoology and botany, is always intransitive (as in 'his eyes closed', not as in 'he closed his eyes'); see e.g. Ar. *De gen an.* 773b15, Theophr. *Hist. plant.* IV.7.8, IV.11.4, [Ar.] *Probl.* 925a29. The text must be corrupt, but I can find no plausible way of repairing it.

²⁷⁹ Here again the writer may be thinking of the sound made when the horns are tapped, as one might tap a pot and listen to the sound to check whether it is cracked; cf. the analogy of masts and pieces of timber at 72.10–15 above, and also 76.14–16.

²⁸⁰ The adjective might mean 'with a straight bore', referring to the hole running through the middle of the horn. But it seems more likely to refer to the 'pores', that is, to very narrow channels within the material itself, since all the other variables are aspects of the horn's material constitution, and resonances are conceived throughout the passage as travelling through solid bodies. Cf. also the allusion to 'pores' at 72.5–6 above.

²⁸¹ Instruments' strings were made from several strands of gut twisted together, and the writer probably means that they are so closely and smoothly intertwined that their separateness is virtually undetectable by sight or by touch.

²⁸² *Zeugē*, 'yokes', as also at 73.5, i.e. the reeds of the mouthpiece; cf. n. 270 above.

- (5) δι' ὕγρου καὶ λείου φέρεται μαλακὸς καὶ ὁμαλός. δῆλον δέ· καὶ γὰρ αὐτὸ τὸ πνεῦμα, ὅταν ἔχη νοτίδα, πολὺ ἤττον προκόπτει πρὸς τὰ ζεύγη καὶ διασπᾶται· τὸ δὲ ξηρὸν μᾶλλον ἀντιλαμβάνεται καὶ τὴν πληγὴν ποιεῖται σκληροτέραν διὰ τὴν βίαν.

- Αἱ μὲν οὖν διαφοραὶ τῶν ἤχων γίνονται διὰ τὰς εἰρημένας αἰτίας· σκληρὰ δ' εἰσὶ τῶν φωνῶν, ὅσαι βιαίως πρὸς τὴν ἀκοὴν προσπίπτουσιν·
- (10) διὸ καὶ μάλιστα παρέχουσι τὸν πόνον. τοιαῦται δ' εἰσὶν αἱ δυσκινήτοτε-
ραι καὶ μετὰ πλείστης φερόμεναι βίας· τὸ γὰρ ὑπεῖκον ταχέως οὐ δύνα-
ται τὴν πληγὴν ὑπομένειν, ἀλλ' ἀποπηδᾷ πρότερον. δῆλον δέ· τὰ γὰρ
ὑπέρογκα τῶν βελῶν βαιοτάτην φέρεται τὴν φορὰν, καὶ τὰ ρεύματα
φερόμενα διὰ τῶν εὐρίπων· καὶ γὰρ ταῦτα γίνεται σφοδρότατα περὶ
- (15) αὐτὰς τὰς στενοχωρίας, οὐ δυνάμενα ταχέως ὑπέικειν, ἀλλ' ὑπὸ πολλῆς
ὠθούμενα βίας· ὁμοίως δὲ τοῦτο συμβαίνει καὶ περὶ τὰς φωνὰς καὶ τοὺς
ψόφους. φανερὸν δ' ἐστίν· πάντες γὰρ οἱ βίαιοι γίνονται σκληροί, καθά-
περ καὶ τῶν κιβωτίων καὶ τῶν στροφέων, ὅταν ἀνοίγωνται βιαίως, καὶ
τοῦ χαλκοῦ καὶ τοῦ σιδήρου· καὶ γὰρ ἀπὸ τῶν ἀκμόνων γίνεται σκλη-
- (20) ρός, καὶ μᾶλλον ὅταν ἐλαύνωσι κατεψυγμένον καὶ σκληρὸν ἤδη τὸν
σίδηρον· ἔτι δ' ἀπὸ τῆς ρίνης, ὅταν ρίνῳσι καὶ χαράττωσι τὰ σιδήρια
καὶ τοὺς πρίονας, ἐπεὶ καὶ τῶν βροντῶν αἱ βιαιόταται γίνονται σκληρότα-
ται καὶ τῶν ὑδάτων τὰ καλούμενα ῥαγδαῖα τὴν βίαν. ἡ μὲν γὰρ ταχυ-
τῆς τοῦ πνεύματος ποιεῖ τὴν φωνὴν ὀξεῖαν, ἡ δὲ βία σκληράν· διόπερ
- (25) οὐ μόνον συμβαίνει τοὺς αὐτοὺς ὅτε μὲν ὀξυτέραν, ὅτε δὲ βαρυτέραν,
ἀλλὰ καὶ σκληροτέραν καὶ μαλακωτέραν. καίτοι τινὲς ὑπολαμβάνουσι
διὰ τὴν σκληρότητα τῶν ἀρτηριῶν τὰς φωνὰς γίνεσθαι σκληράς, δια-
μαρτάνοντες· τοῦτο μὲν γὰρ βραχὺ τι συμβάλλεται παντελῶς, ἀλλ' ἡ
τοῦ πνεύματος γινομένη πληγὴ βιαίως ὑπὸ τοῦ πνεύμονος· ὥσπερ γὰρ
- (30) καὶ τὰ σώματα τῶν μὲν ἐστὶν ὑγρὰ καὶ μαλακά, τῶν δὲ σκληρὰ καὶ σὺν-
τονα, τὸν αὐτὸν τρόπον καὶ ὁ πνεύμων· διόπερ τῶν μὲν μαλακὸν ἐκ-
πίπτει τὸ πνεῦμα, τῶν δὲ σκληρὸν καὶ βίαιον, ἐπεὶ διότι γε τὴν ἀρτηρίαν
αὐτὴν μικρὰν τίνα συμβαίνει παρέχεσθαι δύναμιν, ῥάδιον συνιδεῖν. οὐ-
δεμία γὰρ ἐστὶν ἀρτηρία σκληρὰ τοῖς αὐλοῖς ὁμοίως, ἀλλ' οὐθὲν ἤττον δι'
- (35) αὐτῆς καὶ διὰ τούτων φερομένου τοῦ πνεύματος, οἱ μὲν μαλακῶς αὖ-
λοῦσιν, οἱ δὲ σκληρῶς. δῆλον δὲ τοῦτ' ἐστὶ καὶ ἐπ' αὐτῆς τῆς αἰσθήσεως.
καὶ γὰρ ἂν ἐπιτείνῃ τις τὸ πνεῦμα βιαιότερον, εὐθέως ἡ φωνὴ γίνεται
σκληροτέρα διὰ τὴν βίαν, κἂν ἡ μαλακωτέρα· τὸν αὐτὸν δὲ τρόπον καὶ
ἐπὶ τῆς σάλπιγγος· διὸ καὶ πάντες, ὅταν κωμάζωσιν, ἀνιάσιν ἐν τῇ
- (5) σάλπιγγι τὴν τοῦ πνεύματος συντονίαν, ὅπως ἂν ποιῶσι τὸν ἦχον ὡς
μαλακώτατον.

is unpleasant, for the air travels through what is moist and smooth in a soft and even state. This is obvious, for | the breath itself, when it contains moisture, catches much less on the reeds and is less dispersed. Dry breath is more obstructed, and it makes a harder impact because of the force.²⁸³

The differences between resonances arise, then, for the reasons mentioned.²⁸⁴ Voices are hard if they impinge violently on the hearing, | and this is why they, most of all, cause pain. Those that are harder to move and travel with the greatest violence are of this sort, for something that yields quickly cannot resist the impact but springs away instead. This is obvious, for very heavy missiles travel with the most violent movement, and so do streams running through narrow ditches; for these are most vigorous around | the narrow places, where they cannot yield quickly but are pressed upon with great force. The situation is the same with voices and sounds. This is clear, for all violent sounds are hard, as are those of boxes and hinges when they are opened violently, and those of bronze and iron. For the sound from anvils is hard, | [803a] and more so when they beat iron that is already cooled and hard; and so is that from the file, when they file and sharpen iron things and saws, just as the most violent thunder-claps and the rain-storms described as 'furious in violence'²⁸⁵ are the hardest.

Swiftiness of the breath makes the voice high pitched, and force makes it hard. This is why | the same people not only produce sometimes a higher voice and sometimes a lower, but also sometimes a harder and sometimes a softer voice. Yet some people suppose that voices are hard because of the hardness of the windpipes; but they are wrong.²⁸⁶ For this contributes very little, and <the main cause is> the impact of breath <made> violently by the lung. For just as | some bodies are moist and soft while others are hard and tense, so in the same way is the lung. Hence the breath emitted from some <lungs> is soft, while that emitted from others is hard and violent; for it is easy to see that the windpipe itself provides little power. For no windpipe is as hard as *auloi*, but nevertheless, | when the breath travels through it and through them, some people pipe softly and some harshly.²⁸⁷ This is clear

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²⁸³ I.e. the force required to propel it between the reed-tongues of the mouthpiece.

²⁸⁴ The writer seems to be telling us that he has completed his account of the attributes of *ēchoi*, 'resonances'; in the next sentence he returns to those of *phōnai*, 'voices' or sounds in general. Cf. n. 275 above.

²⁸⁵ Cf. the phrase ὄδρατι βρογδαίω at Plut. *Timoleon* 28.4 (my thanks to an anonymous reader for the reference).

²⁸⁶ The writer may be thinking of Aristotle; cf. the last sentences of *De gen. an.* 788a, which parallels this passage in several respects. Cf. also 74.18–20, with which the present passage consorts rather uncomfortably.

²⁸⁷ As it stands, the sentence implies that when people play *auloi*, part of the passage through which the breath passes is the windpipe; this is very soft, but players can nevertheless pipe harshly as well as softly. But no other text connects attributes of the windpipe with the quality of the sound of an *aulos*. Perhaps the writer has been careless, or perhaps a couple of words have dropped out of the text. At any rate, the intended sense must be '... some people utter (vocally) softly and some harshly, and some pipe softly and some harshly'.

- Φανερόν δ' ἐστὶ καὶ ἐπὶ τῶν ὀργάνων· καὶ γὰρ αἱ κατεστραμμένοι χορδαί, καθάπερ εἴρηται, τὰς φωνὰς ποιοῦσι σκληροτέρας, καὶ τὰ κατωπτημένα τῶν κεράτων. κἄν <τις> ἄπτηται τῶν χορδῶν ταῖς χερσὶ
- (10) βιαίως καὶ μὴ μαλακῶς, ἀνάγκη καὶ τὴν ἀνταπόδοσιν αὐτὰς οὕτω πάλιν ποιεῖσθαι βιαιοτέραν. αἱ δ' ἤττον κατεστραμμένοι καὶ τὰ ὠμότερα τῶν κεράτων τὰς φωνὰς ποιεῖ μαλακώτερας, καὶ τὰ μακρότερα τῶν ὀργάνων· αἱ γὰρ τοῦ ἀέρος πληγαὶ καὶ βραδύτεραι καὶ μαλακώτεραι γίνονται διὰ τὰ μήκη τῶν τόπων, αἱ δ' ἐπὶ τῶν βραχυτέρων σκληροτάται διὰ
- (15) τὴν κατάτασιν τῶν χορδῶν. δῆλον δ' ἐστίν· καὶ γὰρ αὐτοῦ τοῦ ὀργάνου σκληροτέρας συμβαίνει γίνεσθαι τὰς φωνὰς, ὅταν μὴ κατὰ μέσον τις ἄπτηται τῶν χορδῶν, διὰ τὸ μᾶλλον αὐτῶν τὰ πρὸς αὐτῷ τῷ ζυγῷ καὶ τῷ χορδοτόνῳ κατατετάσθαι. συμβαίνει δὲ καὶ τὰ νερθήκινα τῶν ὀργάνων τὰς φωνὰς ἔχειν ἀπαλωτέρας· οἱ γὰρ ἤχοι πρὸς μαλακὸν προσπίπτοντες οὐχ ὁμοίως ἀποπτηδῶσι μετὰ βίας. τραχύνεσθαι δὲ συμβαίνει
- (20) τὰς φωνὰς, ὅταν ἡ πληγὴ μὴ μία γένηται τοῦ ἀέρος παντός, ἀλλὰ πολλαχῇ κατὰ μικρὰ διεσπασμένη· καθ' αὐτὸ γὰρ ἕκαστον τῶν τοῦ ἀέρος μορίων προσπίπτει πρὸς τὴν ἀκοήν, ὥσάν ἀπὸ πληγῆς ἑτέρας ὅν, διεσπασμένην ποιεῖ τὴν αἴσθησιν, ὥστε τὴν μὲν διαλείπειν τὴν φωνήν, τὴν
- (25) δὲ προσπίπτειν βιαιότερον, καὶ γίνεσθαι τὴν ἀφήν τῆς ἀκοῆς ἀνομοίαν, ὥσπερ καὶ ὅταν τι τῶν τραχέων ἡμῖν προσπίπτῃ πρὸς τὸν χρῶτα.
- Μάλιστα δὲ τοῦτο συμφανὲς ἐστὶν ἐπὶ τῆς ρίνης· διὰ γὰρ τὸ τὴν τοῦ ἀέρος πληγὴν ἅμα γίνεσθαι κατὰ μικρὰ καὶ πολλά, τραχεῖς οἱ ψόφοι προσπίπτουσιν ἀπ' αὐτῶν πρὸς τὴν ἀκοήν, καὶ μᾶλλον ὅταν πρὸς σκληρόν τι παρατρίβωνται, καθάπερ καὶ ἐπὶ τῆς ἀφῆς· τὰ γὰρ σκληρὰ καὶ
- (30) τραχέα βιαιότερον ποιεῖται τὴν αἴσθησιν. δῆλον δὲ τοῦτ' ἐστὶ καὶ ἐπὶ τῶν ρευμάτων· τοῦ γὰρ ἐλαίου γίνεται πολὺ πάντων τῶν ὑγρῶν ὁ ψόφος ἀδηλότερος διὰ τὴν συνέχειαν τὴν τῶν μορίων. λεπτὰ δ' εἰσὶ τῶν φω-
- (75) νῶν, ὅταν ὀλίγον ᾖ τὸ πνεῦμα τὸ ἐκπίπτειν. διὸ καὶ τῶν παιδίων γίνονται λεπταί, καὶ τῶν γυναικῶν καὶ τῶν εὐνούχων· ὁμοίως δὲ καὶ τῶν διαλελυμένων διὰ νόσον ἢ πόνον ἢ ἀτροφίαν· οὐ δύνανται γὰρ πολὺ τὸ πνεῦμα διὰ τὴν ἀσθένειαν ἐκπέμπειν. δῆλον δ' ἐστὶ καὶ ἐπὶ τῶν χορδῶν·
- (5) ἀπὸ γὰρ τῶν λεπτῶν καὶ τὰ φωνία γίνεται λεπτὰ καὶ στενὰ καὶ τριχώδη διὰ τὸ καὶ τοῦ ἀέρος τὴν πληγὴν γίνεσθαι κατὰ στενόν. οἷας γὰρ ἂν τὰς ἀρχὰς ἔχωσι τῆς κινήσεως αἱ τοῦ ἀέρος πληγαί, τοιαύτας καὶ τὰς

9 <τις> add. Bekker 11 ποιεῖσθαι om. T προεῖσθαι p 13 βραδύτεραι| βαρύτεραι g
 14 βραχυτέρων Prantl βαρυτέρων codd. σκληρότεραι g 15 κατάτασιν Bekker κατάστασιν
 codd. 17 τὸ T τῶν ceteri 19 πρὸς μαλακὸν om. T προσπίπτοντος G 26 καὶ om. g
 28 ante μικρὰ add. γάρ Mg 30 προστρίβωνται G

3 δύναται om. G

too from the evidence of sense-perception itself, for if one strains the breath more forcefully, the voice immediately becomes harder because of the force, even if it is relatively soft. It is the same in the case of the *salpinx*, which is why everyone relaxes | the tension of the breath in the *salpinx* when they are revelling, to make the sound (*ēchos*) as soft as possible.²⁸⁸

This is evident in the case of instruments too, for tightly twisted strings make the voices harder, as we have said, and so do horns that have been baked; and if one plucks the strings with one's hands | violently and not softly, in the same way they too will inevitably make a more violent response. Those that are less tightly twisted and horns that are less baked make the voices softer, and so do larger instruments; for the impacts on the air are both slower and softer because of the lengths of the distances, while those made by shorter instruments are harder because of | the tension of the strings. This is obvious, for the voices of a single instrument are harder when one does not pluck the strings in the middle, because the parts of them nearer to the cross-bar and the string-holder are under greater tension. It is also the case that instruments made of fennel stalks have gentler sounds, for when the resonances (*ēchoi*) [803b] impinge on something soft | they do not spring away with the same amount of force.²⁸⁹

Voices are made rougher when there is not just one impact on all the air, but it is broken into small fragments in many places. For when each of the portions of air strikes the hearing separately, as if it came from a different impact, it produces a fragmented sense-impression, so that one sound fails while another | impinges more violently, and the contact with the hearing is uneven, just as when something rough impinges on our skin. This is most evident in the case of the file; for because the impact on the air is in many small bits, the sounds from them that strike the hearing are rough, and the more so when <files> | are rubbed against something hard, just as with the sense of touch, since hard and rough things make the sensation more violent. It is obvious too in the case of things that flow, for the sound of oil is much the least conspicuous of all liquids, because of the cohesiveness of its parts.

Thin voices occur when the amount of breath that emerges is small. This is why the voices of children, women and eunuchs are thin, and similarly those of people weakened by illness or labour or lack of food; for because of their weakness they cannot expel much breath. This is also obvious in strings, | for the little voices²⁹⁰ from thin strings are thin and narrow and hair-like, because the impact on the air also occurs on a narrow front. For whatever qualities may inhere in the sources of movement of the impacts on the air, the voices that impinge on the hearing will have the same qualities,

[75D]

²⁸⁸ This allusion to the use of the *salpinx* ('trumpet') in the context of revelry (*botan kōmazōsin*) is unusual, perhaps unique. The intriguing interpretation offered by West (1992): 119 n.179 may be on the right lines, but he is wrong to treat 'soft' (*malakos*) here as meaning 'at low volume'. The adjective never means 'quieter', and the writer is not discussing volume but timbre.

²⁸⁹ Compare 73.26–74.1 with n. 287 above.

²⁹⁰ *Phōnia*, the plural of a diminutive form of *phōnē*.

φωνάς συμβαίνει γίνεσθαι προσπιπτούσας πρὸς τὴν ἀκοήν, οἷον ἀραιάς ἢ πυκνάς ἢ μαλακάς ἢ σκληράς ἢ λεπτάς ἢ παχείας. αἶ γὰρ ὁ ἕτερος (10) ἄηρ τὸν ἕτερον κινῶν ὡσαύτως ποιεῖ τὴν φωνὴν ἅπασαν ὁμοίαν, καθάπερ ἔχει καὶ ἐπὶ τῆς ὀξύτητος καὶ τῆς βαρύτητος. καὶ γὰρ τὰ τάχη τὰ τῆς πληγῆς τὰ ἕτερα τοῖς ἑτέροις συνακολουθοῦντα διαφυλάττει τὰς φωνάς ταῖς ἀρχαῖς ὁμοίως.

Αἱ δὲ πληγαὶ γίνονται μὲν τοῦ ἀέρος ὑπὸ τῶν χορδῶν πολλαὶ καὶ (15) κεχωρισμέναι, διὰ δὲ σμικρότητα τοῦ μεταξύ χρόνου τῆς ἀκοῆς οὐ δυναμένης συναισθάνεσθαι τὰς διαλείψεις, μία καὶ συνεχὴς ἡμῖν ἡ φωνὴ φαίνεται, καθάπερ καὶ ἐπὶ τῶν χρωμάτων· καὶ γὰρ τούτων τὰ διεστηκότα δοκεῖ πολλάκις ἡμῖν συνάπτειν ἀλλήλοις, ὅταν φέρωνται ταχέως. τὸ δ' αὐτὸ συμβαίνει τοῦτο καὶ περὶ τὰς συμφωνίας. διὰ γὰρ τὸ περι- (20) συγκαταλαμβάνεσθαι τοὺς ἑτέρους ἤχους ὑπὸ τῶν ἐτέρων, καὶ γίνεσθαι τὰς καταπαύσεις αὐτῶν ἅμα, λανθάνουσιν ἡμᾶς αἱ μεταξύ γινόμεναι φωναί. πλεονάκεις μὲν γὰρ ἐν πάσαις ταῖς συμφωνίαις ὑπὸ τῶν ὀξυτέρων φθόγγων αἱ τοῦ ἀέρος γίνονται πληγαὶ διὰ τὸ τάχος τῆς κινήσεως· τὸν δὲ τελευταῖον τῶν ἤχων ἅμα συμβαίνει προσπίπτειν ἡμῖν πρὸς τὴν (25) ἀκοήν καὶ τὸν ἀπὸ τῆς βραδυτέρας γινόμενον· ὥστε τῆς ἀκοῆς οὐ δυναμένης αἰσθάνεσθαι, καθάπερ εἴρηται, τὰς μεταξύ φωνάς, ἅμα δοκοῦμεν ἀμφοτέρων τῶν φθόγγων ἀκούειν συνεχῶς. παχεῖαι δ' εἰσὶ τῶν φωνῶν τοῦναντίον, ὅταν ᾗ τὸ πνεῦμα πολὺ καὶ ἀθρόον ἐκπίπτον· διὸ καὶ τῶν

10 ὁμοίως p 21 λανθάνουσαι p 23 φθόγγων om. T τῶν κινήσεων ss. m. pr. τῆς ως MG
24 τόν] τό p

for instance being diffuse or dense or soft or hard or thin or thick. For each portion | of air moves the next in the same way and makes the voice alike throughout, as is the case too with high and low pitch. For as the speeds of the impact follow closely upon one another, they preserve the voices' similarity to their sources.²⁹¹

Many separate impacts are made by strings | on the air, but because of the smallness of the time between them the hearing cannot detect the gaps, and the voice seems to us to be one and continuous, as in the case of colours.²⁹² For their separate parts, too, often seem to us to be joined to one another, when they are travelling quickly. The same thing happens with concords, for since | each set of sounds (*ēchoi*) is embraced by the other, and their endings occur [804a] simultaneously, the intervening voices (*phōnai*) escape our notice. For in all concords the impacts of the higher notes occur more frequently, because of the swiftness of the movement, but the last of its sounds (*ēchoi*) impinges on our | hearing at the same moment as that of the slower.²⁹³ Thus since the hearing cannot perceive the intervening voices (*phōnai*), as we have said, we seem to hear both the notes at the same time, continuously.

Thick voices arise in the opposite way, when a large amount of breath emerges, massed together.²⁹⁴ This is why the voices of men are thicker, and

²⁹¹ Porphyry has already quoted 74.33–75.13 at 50.14–27. The principle that the qualities of the physical causes are always replicated in the audible effects (75.6–9) is fundamental to the explanations of sound-qualities offered in this treatise; the quality of a sound-producing object and the corresponding quality of the sound produced are conceived as being the same in both cases, despite the fact that they characterise items of quite different sorts; in many cases the cause and the effect are described by the same adjective. The first clause of the final sentence evidently means that the speed with which one portion of air travels as a sound is propagated is much the same as that of its predecessor and its successor; but the way the thought is expressed is nearly as odd in Greek as it is in English.

²⁹² With this paragraph compare the quotations from Heraclides at 30.1–31.21, especially the latter part, and from the *Sectio canonis* at 90.7–22.

²⁹³ The thesis is that when two notes forming a concord are played together, we register only the moments at which the impacts of each coincide (their 'endings', cf. [Aristotle] *Probl.* XIX.39), and not those that fall separately between them. It seems odd that at 75.22 and 26 the writer refers to the undetected sounds that fall between coinciding impacts as *phōnai*, 'voices', since the word usually refers precisely to sounds in the form in which we hear them. On the elusiveness of the sense of the term *ēchos* see Introduction pp. 54–5. This feature may explain why the writer chose it when referring to the sounds produced from all the impacts involved, whether they are detectable or not, since such items have only a weak claim to be called 'sounds'. None of them is detected individually, so that each is an acoustic component of an audible sound without, strictly speaking, being an audible sound itself. Heraclides uses *ēchos* once (31.13) in the way it is used here, and once in a quite different way, to refer to the apparently continuous sound that is registered by the ear. In trying to convey their views on this matter, both Heraclides and the present writer seem to have difficulty in choosing an appropriate and consistent vocabulary.

²⁹⁴ This picks up the thread from the discussion of thin voices at 74.33–75.6. 75.6–13 presents a generalised statement of a principle underlying both that discussion and most of the writer's other explanations of a sound's attributes; and this hardly disturbs the sequence of thought. But the excursus on separate impacts and apparent continuity at 75.14–27 seems incongruous here, and has perhaps been displaced from some other point in the text. If so its original position was probably at or before 70.18.

- ἀνδρῶν εἰσι παχύτεραι καὶ τῶν τελείων αὐλῶν, καὶ μᾶλλον ὅταν πληρώσῃ
- (30) τις αὐτοῦς τοῦ πνεύματος. φανερόν δ' ἐστίν· καὶ γὰρ ἂν πίεσῃ τις τὰ ζεύγη, μᾶλλον ὀξυτέρα ἢ φωνὴ γίνεται καὶ λεπτοτέρα, κἂν κατασπάσῃ τις τὰς σύριγγας· κἂν δ' ἐπιλάβῃ, παμπλείων ὁ ὄγκος γίνεται τῆς φωνῆς διὰ τὸ πλήθος τοῦ πνεύματος, καθάπερ καὶ ἀπὸ τῶν παχυτέρων χορδῶν. παχεῖται δὲ γίνονται καὶ τῶν τραγιζόντων καὶ τῶν βραγχιώντων, καὶ
- (76) μετὰ τοὺς ἐμέτους, διὰ τὴν τραχύτητα τῆς ἀρτηρίας καὶ διὰ τὸ μὴ ὑπεξάγειν, ἀλλ' αὐτοῦ προσκόπτουσιν ἀνειλεῖσθαι τὴν φωνὴν καὶ λαμβάνειν ὄγκον, καὶ μάλιστα διὰ τὴν ὑγρότητα τοῦ σώματος. λιγυραὶ δ' εἰσὶ τῶν φωνῶν αἱ λεπταὶ καὶ πυκναί, καθάπερ καὶ ἐπὶ τῶν τεττίγων καὶ τῶν
- (5) ἀκρίδων καὶ αἱ τῶν ἀηδόνων, καὶ ὅλως ὅσαις λεπταῖς οὖσαις μηθεὶς ἀλλότριος ἦχος παρακολουθεῖ· ὅλως γὰρ οὐκ ἔστιν οὗτ' ἐν ὄγκῳ φωνῆς τὸ λιγυρόν, οὐτ' ἐν τόνοις ἀνιεμένοις καὶ βάρεσιν, οὐτ' ἐν ταῖς τῶν φθόγγων <συν>αφαῖς, ἀλλὰ μᾶλλον ὀξύτητι καὶ λεπτότητι καὶ ἀκριβείᾳ. διὸ καὶ τῶν ὀργάνων τὰ λεπτὰ καὶ σύντονα καὶ μὴ ἔχοντα κέρας τὰς φωνὰς
- (10) ἔχειν λιγυροτέρας. ὁ γὰρ ἀπὸ τῶν ὑδάτων ἦχος καὶ ὅλως ὅταν ἀπὸ τινος γινόμενος παρακολουθῇ, συγχεῖ τὴν ἀκρίβειαν τὴν τῶν φθόγγων. Σαθραὶ δ' εἰσὶ καὶ παρερρηκυῖαι τῶν φωνῶν, ὅσαι μέχρι τινὸς φερόμεναι συνεχεῖς διασπῶνται.
- φανερώτατον δὲ τοῦτ' ἐστὶν ἐπὶ τοῦ κεράμου· πᾶς γὰρ ὁ ἐκ πληγῆς

29 τελείων] λείων p 32 παμπλείων] πᾶν πλεῖον p 34 βραγχιώντων] βραγχέων τῶν g

1 τραχύτητα om. T 5 ἀλλότριος T 8 <συν>αφαῖς scripsi ἀφαῖς codd. 11 συγχεῖ
Alexanderson συνέχει codd. 12 παρερρηκυῖαι p

so are those of 'complete' *auloi*,²⁹⁵ especially when | one fills them with breath.²⁹⁶ This is clear, for if one compresses the reeds (*zeugē*) the voice becomes higher and thinner, as it does when one pulls down the *syringes*;²⁹⁷ but if one closes them the bulk of the voice becomes much greater because of the quantity of breath, as it does from thicker strings. Voices are also thick in people whose voice is breaking or who have sore throats, and after vomiting, because of the roughness of the windpipe, and because they do not propel <the breath> straight out, but when it strikes this point it amasses there and gains bulk, especially because of the body's moistness.

[76D]

Shrill²⁹⁸ voices are those that are thin and dense, like those of grasshoppers, | crickets and nightingales, and in general those thin voices that are not accompanied by any resonance (*ēchos*) from another source. For shrillness does not at all reside in bulk of voice, or in relaxed and low-pitched tones, or in combinations²⁹⁹ of notes, but rather in high pitch, thinness and precision. This is why instruments that are thin, tense and without a horn have | shriller voices; for the resonance (*ēchos*) that comes off water, or in general that follows on from something else, confuses³⁰⁰ the notes' precision.

Cracked and broken voices are those that travel as continuous wholes up to a certain point and are then fragmented. This is clearest in the case of

²⁹⁵ Aristoxenus gave a classification of five types of *aulos*, based on their ranges of pitch, recorded at Athenaeus 634f. 'Complete' (*teleioi*) *auloi* are the second-lowest type in the catalogue.

²⁹⁶ That is, when one plays the instrument's lowest note, for which the breath must travel through and so 'fill' the whole pipe.

²⁹⁷ The allusion is to a device analogous to the speaker-hole on a modern instrument, which when opened (by 'pulling down' the knob on the rotating collar that covered it) gave access to the higher harmonics. (Cf. Aristox. *El. harm.* 20.33–21.5, Plut. *Non posse suav.* 1096b.) The suggestion that this was its function was first made by Howard (1893): 32–5; any remaining doubts about it should be put to rest by the details presented in Hagel (2012a).

²⁹⁸ With the exception of compounds formed by the addition of a suffix meaning 'sounding', *ligyros* and *ligys* (which seem to be interchangeable) are the only Greek adjectives used solely or primarily to describe sounds. All the others are either transferred from some other sense-domain (e.g. the familiar *oxys*, 'sharp' when used of tangible objects, 'high-pitched' when used of sounds), or are general terms applicable across all or several domains (e.g. *meγas*, 'large', acoustically 'loud'). 'Shrill' is the best translation of *ligyros* I can offer that fits the account given here; elsewhere (as e.g. in Homer) it seems capable of characterising any sound that is clear and penetrating, without necessarily fulfilling all the other conditions mentioned in this passage.

²⁹⁹ I take the author to be thinking of cases in which two notes are played simultaneously, so that each of them obstructs our perception of the other; see 70.30–71.2 above. The MSS reading, *haphais*, might possibly be used here in the sense 'combinations', but in musical contexts the noun standardly refers to a 'touch' on an instrument's string, i.e. the act of plucking, and has nothing to do with 'combining' notes, whether simultaneously or in sequence. My emendation, which adds the prefix *syn*, 'together', to the noun *haphais*, will give the required sense.

³⁰⁰ The MSS reading *synchei* is probably wrong. It is capable of meaning 'hinders', but more often (and elsewhere in this text) it has in effect the opposite sense, 'holds together', 'maintains'. In the light of the reference to a horn, and of the long discussion of their *ēchoi* at 71.32 ff., that is patently not what is meant here; Alexanderson's substitution of *synchei* ('confuses') resolves the problem. His further suggestion that we might read *keratōn*, 'horns', in place of *hydatōn*, 'waters', is tempting. It gives the sense 'the resonance that comes from horns', which would be very apt here, but even he admits that the change is 'rather violent'.

- (15) ῥαγείς ποιεῖ τὸν ἦχον σαθρόν, διασπωμένης τῆς κινήσεως τὰ κατὰ τὴν πληγὴν, ὥστε μηκέτι γίνεσθαι τοὺς ἐκπίπτοντας ἦχους συνεχεῖς. ὁμοίως δὲ τοῦτο συμβαίνει καὶ ἐπὶ τῶν ἔρρωγόντων κεράτων καὶ ἐπὶ τῶν χορδῶν τῶν <παρα>νευρισμένων. ἐπὶ πάντων μὲν γὰρ τῶν τοιούτων μέχρι μὲν τινος ὁ ἦχος φέρεται συνεχῆς, ἔπειτα διασπᾶται, καθ' ὃ τι ἂν ἡ μὴ
- (20) συνεχὲς τὸ ὑποκείμενον, ὥστε μὴ μίαν γίνεσθαι πληγὴν, ἀλλὰ διεσπασμένην, καὶ φαίνεσθαι τὸν ἦχον σαθρόν· σχεδὸν γὰρ παραπλήσιαι τυγχάνουσιν οὕσαι τοῖς τραχεῖαις, πλὴν ἐκεῖναι μὲν εἰσιν ἀπ' ἀλλήλων κατὰ μικρὰ μέρη διεσπασμένα, τῶν δὲ σαθρῶν αἱ πλεῖσται τὰς μὲν ἀρχὰς ἔχουσι συνεχεῖς, ἔπειτ' εἰς πλείω μέρη τὴν διαίρεσιν λαμβάνουσιν. δια-
- (25) σεῖται δ' εἰσὶ τῶν φωνῶν, ὅσαις ἔσωθεν τὸ πνεῦμα εὐθέως συνεκβάλλομεν μετὰ τῶν φθόγγων. ψιλαὶ δ' εἰσὶ τούναντίον, ὅσαι γίνονται χωρὶς τῆς τοῦ πνεύματος ἐκβολῆς. ἀπορρηγνυσθαι δὲ συμβαίνει τὰς φωνάς, ὅταν μηκέτι δύνωνται τὸν ἀέρα μετὰ πληγῆς ἐκπέμπειν, ἀλλ' ὁ περὶ τὸν πνεῦμονα τόπος αὐτῶν ὑπὸ τῆς διατάσεως ἐκλυθῇ· ὥσπερ γὰρ καὶ τὰ σκέλη
- (30) καὶ τοὺς ὦμους ἐκλύεσθαι συμβαίνει τὸ τελευταῖον συντόνως, οὕτω καὶ τὸν περὶ τὸν πνεῦμονα τόπον. κοῦφον γὰρ ἔξω φέρεσθαι τὸ πνεῦμα διὰ τὸ μὴ γίνεσθαι βίαιον αὐτοῦ τὴν πληγὴν. ἅμα δὲ καὶ διὰ τὸ τετραχύνθαι τὴν ἀρτηρίαν αὐτῶν ἰσχυρῶς οὐ δύναται τὸ πνεῦμα ἔξω φέρεσθαι συ-
- (77) νεχές, ἀλλὰ διεσπασμένον ὡς ἀπερρωγυίας γίνεσθαι τὰς φωνὰς αὐτῶν. καὶ τινες οἶονται διὰ τὴν τοῦ πνεύμονος γλισχρότητα τὸ πνεῦμα οὐ δύνασθαι περαιουῖσθαι πρὸς τὸν ἔξω τόπον, διαμαρτάνοντες· φθέγγονται μὲν γὰρ, ἀλλ' οὐ δύναται γεγωνεῖν, διὰ τὸ μὴ γίνεσθαι μετὰ συντονίας
- (5) τὴν τοῦ ἀέρος πληγὴν, ἀλλὰ μόνον φωνοῦσιν, ὡς ἂν ἀπ' αὐτοῦ τοῦ φάρυγγος τὸ πνεῦμα βιαζόμενον.
- Τῶν δ' ἰσχυφώνων οὔτε περὶ τὰς φλέβας, οὔτε περὶ τὰς ἀρτηρίας ἐστὶ τὸ πάθος, ἀλλὰ περὶ τὴν κίνησιν τῆς γλώττης. χαλεπῶς γὰρ αὐτὴν μεταφέρουσιν, ὅταν ἕτερον δέη φθόγγον εἰπεῖν· διὸ καὶ πολὺν χρόνον τὸ
- (10) αὐτὸ ῥῆμα λέγουσιν, οὐ δυνάμενοι τὸ ἐξῆς εἰπεῖν, ἀλλὰ συνεχῶς τῆς κινήσεως καὶ τοῦ πνεύμονος αὐτῶν ἐπὶ τὴν αὐτὴν ὁρμὴν φερομένου διὰ τὸ πλήθος καὶ τὴν βίαν τοῦ πνεύματος· ὥσπερ γὰρ καὶ τὸ σῶμα ὅλον τῶν τρεχόντων βιαίως χαλεπὸν ἐστὶν ἐκ τῆς ὁρμῆς εἰς ἄλλην κίνησιν μεταστῆσαι, τὸν αὐτὸν τρόπον καὶ κατὰ μέρος· διὸ καὶ πολλάκις τὸ μὲν
- (15) ἐξῆς εἰπεῖν οὐ δύναται, τὸ δὲ μετὰ τοῦτο λέγουσι ῥαδίως, ὅταν ἄλλην

18 <παρα>νευρισμένων Düring teste Arist. *Hist. an.* 581a20 νευρισμένων codd.
 27 προσρηγνυσθαι MEV^{187g} 29 διατάσεως Düring διαστάσεως codd. ἐκλυθῇ] ἐκβληθῇ
 T σκέλη Wallis σκεύη codd.

2 καὶ T καίτοι ceteri πνεύμονος T πνεύματος ceteri 3 πρὸς Düring περὶ codd. 10 συνεχῶς]
 συνεχούς fortasse legendum 12 πνεύματος T πνεύμονος ceteri

pottery, for every pot that has been broken | by an impact makes a cracked resonance (*ēchos*), since the movement is fragmented at the point of impact, so that the resonances that emerge cannot be continuous. The same thing happens with broken horns and with badly twisted strings, since in all such cases the resonance travels as a continuous whole up to [804b] a certain point, and is then fragmented wherever | the material is not continuous, so that the impact is not one but fragmented, and the resonance seems cracked. For these voices are very like rough ones, except that the latter are fragmented into small, separate pieces, while most cracked voices have beginnings that are continuous wholes, and are divided into several parts later.

| Aspirated voices are those in which we expel the breath immediately along with the notes. Un-aspirated voices, conversely, are those that are made without the expulsion of the breath.³⁰¹

Voices are broken when people can no longer emit the air with an impact, but the region around their lung fails under the strain. For just as the legs | and the shoulders eventually fail under tension, so it is too with the region around the lung, since the breath travels outside feebly because the impact on it has no force. At the same time, because their windpipe is roughened the breath cannot travel to the outside powerfully as a continuous whole, but is fragmented, so that their voices are broken. Some people think that it is because of the lung's stickiness that the breath cannot come through to the region outside, but they are wrong. For such people do utter, but they cannot <make their voices> ring out, because the impact on the air | is made without tension; so they speak only as if the breath were being forced out from the pharynx itself.

[77D]

The affliction of stammerers is not based in the ducts³⁰² or the windpipe, but in the movement of the tongue. For they have difficulty in changing its position when they want to utter a different note.³⁰³ This is why they | speak the same syllable for a long time, unable to say the one that follows, while the movement and the lung are continuously carried along by the same impulse,³⁰⁴ because of the quantity and the force of the breath; for just as the whole body of people running violently is difficult to divert from its impetus into a different movement, so it is with each individual part. This is why | they often cannot utter what comes next, but say what comes after

³⁰¹ In view of the close connection between the paragraphs before and after it, this short passage may be misplaced. Its brevity also suggests that it is one of the passages that Porphyry has not quoted in full (67.20–1).

³⁰² The word *phleps* commonly refers to a blood-vessel, but it can be used of any tubular structure in the body, no matter what its function is thought to be. In the detailed and ingenious work of Diogenes of Apollonia the *phlebes* are the channels along which life-giving air travels throughout the body. I borrow the translation 'ducts' from Lloyd (2006).

³⁰³ 'Note' is presumably inappropriate here, and perhaps therefore also in some other contexts in this treatise. I use it only to preserve consistency in my rendering of the noun *phthonggos*.

³⁰⁴ Or perhaps one might read *synechous* for *synechōs* at 77.10, giving the sense 'while the movement is continuous and the lung is moved by the same impulse'.

ποιήσωνται τῆς κινήσεως ἀρχήν. δῆλον δ' ἐστίν· καὶ γὰρ τοῖς ὀργιζομένοις τοῦτο συμβαίνει πολλάκις διὰ τὸ βίαιον αὐτῶν γίνεσθαι τὴν τοῦ πνεύματος φοράν.”

- Ἄλλα τῶν μὲν παρ' Ἀριστοτέλους περὶ τῆς διαφορᾶς τῶν ἀκουστῶν ἱκανὰ καὶ ταῦτα· εἴρηται γάρ, πῶς τε ἡ φωνὴ γίνεται καὶ πῶς τῶν αὐτῶν ὄντων αἰτίων διάφοροι ἡμῶν αἱ φωναί, πῶς τε ἀκούομεν καὶ πῶς λανθάνουσι τὴν ἀκοὴν αἱ συνέχειαι τῶν πληγῶν ὡς μία αἱ πολλαὶ προσπίπτουσαι. εἴρηται δὲ καὶ περὶ τῶν συμφωνιῶν, δι' ἣν αἰτίαν οἱ ἐναντιώτατοι ψόφοι συγκεκραμένοι ταῖς ἀκοαῖς προσπίπτουσι. καὶ μὴν (25) καὶ περὶ τῶν φυσικῶν ὀργάνων θεθεώρηται, πνεύμονος λέγω καὶ ἀρτηρίας καὶ τοῦ πνεύματος, καὶ λοιπὸν περὶ σχηματισμῶν τῶν κατὰ τοὺς ψόφους. εἴρηται δ' οὐ μόνον περὶ ὀξεῖας καὶ βαρεῖας φωνῆς καὶ τίνα τούτων αἵτια, ἀλλὰ καὶ περὶ τυφλῶν καὶ νεφωδῶν φωνῶν, ἰσχυρῶν τε καὶ ἀσθενῶν, (30) περὶ τε κενῆς φωνῆς, παχείας τε καὶ ἰσχνῆς, σαφοῦς τε καὶ ἀσαφοῦς, περὶ τε λαμπρᾶς, σκληρᾶς τε καὶ μαλακῆς, τραχείας τε καὶ λεπτῆς, λιγυρᾶς τε καὶ σαθρᾶς, δασείας τε καὶ περιερρωγίας, τό τε πάθος τῶν ἰσχυροφώνων ὅπως γίνεται, ὡς πλήρη τὸν περὶ τῆς διαφορᾶς τῶν ψόφων λόγον εἶναι· οὐ μόνον ἐξηγήσεως τυχόντων τῶν ὑπὸ τοῦ Πτολεμαίου εἰρημένων, ἀλλὰ καὶ ἐξετασθέντων καὶ τοῦ ἑλλιποῦς λαβόντων τὴν συμ- (35) πλήρωσιν.
- (78) Μεταβατέον τοίνυν εἰς τὴν περὶ τῶν φθόγγων καὶ τῶν ἐν αὐτοῖς διαφορῶν ἐξήγησιν.

δ'

**Πῶς μὲν οὖν ὀξύτης συνίσταται ψόφου καὶ βαρύτης καὶ ὅτι ποσότης τίς ἐστί τὸ εἶδος αὐτῶν, ὑποτετυπώσθω διὰ τούτων. προσκατανεο-
ήσθω δ' ὅτι καὶ τὰς παραυξήσεις αὐτῶν δυνάμει μὲν ἀπείρους εἶναι
συμβέβηκεν, ἐνεργεῖα δὲ πεπερασμένης ὥσπερ καὶ τὰς τῶν μεγεθῶν . . .**

- (4) Συγκεφαλαιούμενος τὸν περὶ τῆς ὀξύτητος καὶ βαρύτητος λόγον προ-
(5) στίθῃσι καὶ ἄλλο τεκμήριον τοῦ εἶναι ποσότητος ταύτας. καὶ γὰρ αἱ παραυξήσεις αὐτῶν φησι δυνάμει μὲν ἄπειροι, ἐνεργεῖα πεπερασμένοι, καθάπερ καὶ ἐπὶ μεγεθῶν αἱ παραυξήσεις δυνάμει μὲν ἄπειροι, ἐνεργεῖα δὲ πεπερασμένοι. τοῦτο δὲ συμβαίνει διὰ τὸ ἐπ' ἄπειρον τῶν συνεχῶν τομῶν. ἰστέον δέ, ὅτι κἂν ποιότητες ᾧσιν αἱ εἰρημέναι, ἢ γ' ἐπ' ἄπει- (10) ρον διαφορὰ δύναται σφῆζεσθαι, τοῦ Πλάτωνος ἐν τῷ Φιλήβῳ

22 λανθάνουσαι g 24 καί| ναί T 28 καὶ prim. om. p 29 κενῆς| κωφῆς g 32 τόν| τό p

2 τέλος τοῦ τρίτου κεφαλαίου add. p 3 κεφάλαιον δ' περὶ φθόγγων καὶ τῶν ἐν αὐταῖς διαφορῶν T
κεφ. δ' εἰς τὸ πῶς μὲν οὖν ὀξύτης συνίσταται G ἀρχὴ τοῦ τετάρτου κεφαλαίου p

that with ease, when they have made a fresh start to the movement. This is obvious, for the same thing happens also to people who are angry, because the movement of their breath is so violent.

These excerpts from Aristotle's work on the difference | between audible things will be enough. For he has said how the voice arises, how our voices are different while the causes are the same, how we hear, and how the sequences of impacts escape the hearing and the many impacts impinge on it as one. He has spoken also about the concords, explaining the cause through which completely opposite sounds are blended together when they strike our ears. | He has also considered the natural organs, by which I mean the lung, the windpipe and the breath, and in addition the shapings that are given to the sounds. He has spoken not only about high- and low-pitched voices and what their causes are, but also about voices that are muffled and cloudy, strong and weak, about voice that is hollow, thick and slender, clear and unclear, | bright, hard and soft, rough and delicate, shrill and spongy, hoarse and broken, and about how the affliction of stammerers arises; so that his account of the difference between sounds is complete. His statements not only provide an exposition of the things of which Ptolemy spoke, but also scrutinise them and supply | the full complement of what he omitted.

Let us turn, then, to Ptolemy's exposition on the topic of the notes and the differences between them. [78D]

Chapter 4

Let this outline suffice to indicate how height and depth of sound are constituted, and that their form is a kind of quantity. Let it also be understood that their increases are potentially unlimited, but in actuality are limited in the same way as those of the magnitudes . . .³⁰⁵ Ptol. *Harm.* 9.16–19

In summarising his account of high and low pitch, Ptolemy | adds yet another indication too of their being quantities. For he says that their increases are potentially unlimited, though in actuality they are limited, just as with magnitudes the increases are potentially unlimited but in actuality limited. This is because of the unlimited number of successive divisions. But one must realise that even if the attributes mentioned are qualities, the | unlimitedness of the difference can still be preserved, since Plato in the *Philebus* demonstrates the unlimitedness of differences in the case of qualities too.³⁰⁶ The difference involved in being hotter and colder

³⁰⁵ The sentence continues in the next lemma.

³⁰⁶ Plato *Phileb.* 24a, cf. 16c, 17b.

καὶ ἐπὶ τῶν κατὰ τὰς ποιότητος παραλλαγῶν δείξαντος τὴν ἀπειρίαν. τοῦ γὰρ θερμότερου καὶ τοῦ ψυχροτέρου καὶ μελανωτέρου διαφορότητα ἔχουσιν τὴν ἀπειρίαν φησὶν ἐνοικεῖν ἐν αὐτῇ καὶ μὴ ἴστασθαι, ὀρίσθεισαν δὲ ἀπόλλυσθαι. ἐξεργασμένου δὲ τοῦ τόπου παρὰ Γλάτωνι οὐδὲν δεῖ
(15) μηκύνειν τὰς πίστεις ἐκεῖθεν παραγράφοντα. περὶ μέντοι τῆς ἀπειρίας τῶν τάσεων καὶ ὁ Ἀριστόξενος πολλαχοῦ διείλεκται· φησὶ δὲ καὶ ἐν τῷ Περὶ τόνων οὕτως.

“Ληφθέντος γὰρ τοῦ διὰ τεττάρων αἱ μὲν σύμπασαι τάσεις ἐν αὐτῷ
δηλονότι ἄπειροί εἰσιν, ἐπειδὴ περ πᾶν διάστημα διαιρεῖται ἀπειραχῶς,
(20) οἱ δὲ πρὸς ἀλλήλους ἐμμελῆ τάξιν ἔχοντες ἕξ μόνοι.”

Ἐν δὲ τῷ Περὶ τοῦ πρώτου χρόνου καὶ τὴν ἐσομένην ἂν
πρὸς τινων κατηγορίαν ἀπολυόμενος γράφει ταῦτα.

“Ὅτι δ’ εἴπερ εἰσὶν ἐκάστου τῶν ρυθμῶν ἀγωγαὶ ἄπειροι, ἄπειροι
ἔσσονται καὶ οἱ πρώτοι, φανερόν ἐκ τῶν ἔμπροσθεν εἰρημένων. τὸ αὐτὸ
(25) δὲ συμβήσεται καὶ περὶ τοὺς δισήμους καὶ τρισήμους καὶ τετρασήμους
καὶ τοὺς λοιποὺς τῶν ρυθμικῶν χρόνων· καθ’ ἕκαστον γὰρ τῶν πρώτων
τούτων ἔσται δισήμος τε καὶ τρίσημος καὶ τὰ λοιπὰ τῶν οὕτω λεγομέ-

(79) νων ὀνομάτων. δεῖ οὖν ἐνταῦθα εὐλαβηθῆναι τὴν πλάνην καὶ τὴν δι’
αὐτῶν γινομένην παραχῆν. ταχέως γὰρ ἂν τις τῶν ἀπείρων μὲν μου-
σικῆς καὶ τῶν τοιοῦτων θεωρημάτων, ἃ νῦν ψηλαφῶμεν ἡμεῖς, ἐν δὲ
τοῖς σοφιστικοῖς λόγοις καλινδουμένων,

(5) “Ἐριδος ποτὶ μάργον ἔχων στόμα,”

<ὥς> φησὶ πού Ἰβυκος,

‘ἀντία δῆριν ἔμοι κορύσσοι,’

λέγων ὅτι ἄτοπον, εἴ τις ἐπιστήμην εἶναι φάσκων τὴν ρυθμικὴν, ἕξ
ἀπείρων αὐτὴν συντίθησιν· εἶναι γὰρ πολέμιον πάσαις ταῖς ἐπιστήμαις
(10) τὸ ἄπειρον. οἶμαι μὲν οὖν φανερόν εἶναί σοι, ὅτι οὐδὲν προσχρώμεθα
τῷ ἀπείρῳ πρὸς τὴν ἐπιστήμην, εἰ δὲ μή, νῦν ἔσται φανερώτατον. οὕτε
γὰρ πόδας συντίθεμεν ἐκ χρόνων ἀπείρων, ἀλλ’ ἕξ ὠρισμένων καὶ πεπε-
ρασμένων μεγέθει τε καὶ ἀριθμῷ καὶ τῇ πρὸς ἀλλήλους συμετρίᾳ τε
καὶ τάξει, οὔτε ρυθμόν οὐδένα τοιοῦτον ὀρώμεν· δῆλον δέ, εἴπερ μηδὲ
(15) πόδα, οὐδὲ ρυθμόν, ἐπειδὴ πάντες οἱ ρυθμοὶ ἐκ ποδῶν τινων σύγκεινται.

18 ληφθέντος scripsi ληφθέντων γὰρ <τῶν> τοῦ Alexanderson ληφθέντων γὰρ τοῦ codd.
25 συμβήσει g

6 <ὥς> add. Düring 7 ἀντίαν T ἔμοι κορύσσοι Bergk ενιαικορυσσοι codd. II φανερώτερον
T

and darker, he says, has unlimitedness residing in it and is not stably fixed, and when the unlimitedness is made determinate it is destroyed. Since this matter has been thoroughly worked through by Plato, there is no need | to prolong the proof by commenting on the passage.

The unlimitedness of pitches, however, was also discussed in many places by Aristoxenus. In the work *On Tonoï* he speaks as follows: 'If we take the interval of a fourth, it is obvious that the total number of pitches in it is unlimited, since every interval is divisible without limit; | but the <notes> that are in a melodic relation to one another are only six.'³⁰⁷ In his work *On the Primary Duration* he also resolves an objection with which some people might attack him. He writes as follows:

It is clear from what we have already said that if indeed there is an unlimited number of tempi for each of the rhythms, the number of primary <durations> will also be unlimited. The same | will hold of two-unit, three-unit, four-unit and all the other rhythmic durations, since for each of these primary durations there will be a two-unit and a three-unit duration and the rest of those that are spoken of by such names. One must therefore guard against error here, and against the confusion that arises from these facts. For it could easily happen that one of the people who are inexperienced³⁰⁸ in music and in propositions of the sort we are dealing with now, but who wallow in sophistic arguments, | 'may raise up conflict against me', as Ibycus says somewhere, 'with the ravening mouth of Strife' [PMG 311], saying that it is absurd for someone who alleges that rhythemics is a science to compose it out of things that are unlimited; for unlimitedness is hostile to all | the sciences.

[79D]

Now I think it is clear to you³⁰⁹ that we make no use of unlimitedness in the cause of scientific knowledge, and if it is not, it will now become perfectly clear. For we do not compose the feet from unlimited durations but from ones that are determinate and limited in both size and number and in their mutual proportions and arrangement, nor do we see any rhythm of this <indeterminate> sort; and it is obvious that if we treat no | foot like that, neither do we do so to any rhythm, since all rhythms are composed

³⁰⁷ Test. 75 Da Rios. It is not entirely clear why Aristoxenus reckons the number to be six; in his discussion at *El. harm.* 50.15–52.33 he in fact identifies nine different positions for notes between the boundaries of the fourth. Probably he is thinking only of the positions of the note *lichanos* (of which the same passage identifies six), which he regularly treats as the most important note inside the tetrachord; he seems to regard the position of the other movable note, *parhypatē*, as relatively insignificant. Equivalently, he often treats the pair of intervals at the bottom of a tetrachord (the *pyknon* in enharmonic and chromatic) as a single unit; cf. 79.23–28 below.

³⁰⁸ Aristoxenus uses the same word for 'inexperienced' (*apeiros*) as is used for 'unlimited' elsewhere in this passage. With this sentence and the passage as a whole (especially the remarks on harmonics at the end) cf. *El. harm.* 68.13–69.29.

³⁰⁹ 'You' is singular, indicating that this work of Aristoxenus was addressed to a particular individual. The fact is interesting, since there are no signs that his other writings were couched in this form.

- ἐπὶ τῆσδὲ τινος ἀγωγῆς τεθείς ἀπείρων ἐκείνων πρώτων ἓνα τινὰ λήψεται εἰς αὐτόν. ὁ αὐτὸς δὲ λόγος καὶ περὶ τῶν δισήμεων· καὶ γὰρ τούτων ἓνα λήψεται τὸν ζύμμετρον τῷ ληφθέντι πρώτῳ· ὁ αὐτὸς δὲ λόγος
- (20) καὶ ἐπὶ τῶν ἄλλων μεγεθῶν, ὥστ' εἶναι φανερόν, ὅτι οὐδέποτε εὐρεθῆσεται ἡ ῥυθμικὴ ἐπιστήμη τῇ τῆς ἀπειρίας ἰδέᾳ προσχρωμένῃ. δεῖ δὴ καταμαθεῖν, ὅτι καὶ περὶ τῆς ἀρμονικῆς ἐπιστήμης ὁ αὐτὸς ἂν γένοιτο λόγος· φανερόν γάρ καὶ τοῦτο γέγονεν ἡμῖν, ὅτι περὶ τῶν ζυμπάντων διαστημάτων ἄπειρα τυγχάνει τὰ μεγέθη ὄντα, ἀλλὰ τῶν ἀπείρων τούτων πυκνῶν τόδε τὸ σύστημα κατὰ τήνδε τήν χρόαν μελωδοῦμενον ἔν τι λήψεται μέγεθος τόδε· ὡσαύτως δὲ καὶ τῶν ἀπείρων ἐκείνων ὑπερεχόντων ἔν τι λήψεται μέγεθος τόδε τὸ ζύμμετρον τῷ ληφθέντι πυκνῷ. ὑπερέχον δὲ καλῶ τὸ τοιοῦτο οἶον τὸ μέσης καὶ λιχανοῦ διάστημα.”
- (25) Ταῦτα μὲν οὖν μέχρι τούτου εἰρήσθω. τοῖς δ' εἰρημένοις ὁ Πτολεμαῖος ἐπάγει ταῦτα.
- (30)

εἶναι τε δύο τούτων ὅρους τὸν μὲν αὐτῶν τῶν ψόφων ἴδιον, τὸν δὲ τῆς [20] ἀκοῆς, καὶ μείζονα τοῦτον ἐκείνου. τῶν μὲν γὰρ ποιοῦντων τοὺς ψόφους ἐπὶ πλεόν παραλλαττόντων κατὰ τὰς συστάσεις, κἂν αἱ καθ' ἕκαστον ἀπὸ τοῦ βαρυτάτου πρὸς τὸ ὀξύτατον διαστάσεις μηδενὶ ἀξιολόγῳ διαφέρωσιν, ἀλλὰ τὰ γε πέρατα αὐτῶν ἀμφοτέρα διοίσει συχρὸν πολλαχῇ, τῶν μὲν ἐπὶ τὸ βαρύτερον, τῶν δὲ ἐπὶ τὸ ὀξύτερον. ἡ δὲ ἀκοὴ καὶ τῶν [25] βαρυτέρων ἀντιλαμβάνεται τοῦ βαρυτάτου καὶ τῶν ὀξυτέρων τοῦ ὀξυτάτου, καθ' ὅσον ἂν ἐν ταῖς ὀργανοποιίαις ἐπινοῶμεν παραυξίνει τὰς τοσαύτας διαστάσεις.

- (80) Ἐπειδὴ οὖν ἂν ὑποστήσωμεν ἐν τοῖς ὀργάνοις ὀξύτατον ἢ βαρυτάτον φθόγγον, ἀντιλαμβάνεται τούτου ἡ ἀκοὴ καὶ καταλείπει νοεῖν, ὅτι κἂν τούτου γένηται ὀξύτερος ἢ βαρύτερος, ἀντιλαμβάνεται καὶ τούτου. καὶ ἐπιλείπει γ' ἡμᾶς πρότερον ψόφων παραλλαγὴ κατ' ὀξύτητα ἢ βαρύτητα
- (5) εἰς ἐνέργειαν ἀφικνουμένη, ἥπερ ἀκοή. κἂν γὰρ ἀπὸ διαφόρων συστάσεων συνίστανται οἱ ψόφοι, καὶ πολὺ διαφέρουσιν, ἀλλ' αὐτοὶ πέρατα ἔχουσιν κατὰ τε τὸ ὀξύ καὶ τὸ βαρὺ, ὥσάν οὐ μεγάλας ποιοῦντες διαφοράς. διὰ τοῦτο φησι μείζονα εἶναι τὸν ὅρον τῆς ἀκοῆς τοῦ ὅρου τῶν ψόφων, ὅτι προαπαρτίζονται οἱ τῶν ψόφων ὅροι οἱ κατ' ὀξύτητα καὶ
- (10) βαρύτητα διαφέροντες, ἡ ἢ ἀκοὴ ἐκλείπει, ἅτε ἀεὶ καταλαμβάνειν δυνα-

16 δς] ὁ m τροχάιος ss. m.a. T τραχέος codd. 18 ὁ om. T 16 ἐκείνων T ἐκείνω ceteri
6 συνίστανται MEg συνίσταιντο T πολὺ] πολλοὶ MEg διαφέρωσιν T

of feet. In general, then, one must realise that whichever of the rhythms is taken, the trochaic for example, when it is set in any particular tempo it will take to itself a particular one of those unlimited primary durations. The same goes for two-unit durations as well, for it will take the one of them that is proportional to the primary duration that has been taken. The same | goes for the other magnitudes too, so that it is clear that the science of rhythemics will never be found making use of the class of the unlimited. Further, one must understand that the same reasoning can be applied to the science of harmonics. For this too has become clear to us, that the magnitudes of the totality of intervals are unlimited, but that from all of those unlimited | *pykna* this particular scale sung in this particular shade will take this particular magnitude; and in the same way, from those unlimited <magnitudes> that extend beyond the *pyknon*, it will take the one particular magnitude that is proportional to the *pyknon* that has been taken. (By 'extending beyond' I mean such an interval as that between *mesē* and *lichanos*.)³¹⁰

Let that be the end of our discussion of this point. To what he has said, Ptolemy | adds the following:

[continuing the sentence quoted in the previous excerpt]... that they have two boundaries, the one proper to the sounds themselves, the other to the hearing, and that the latter is greater than the former. When the things that make the sounds alter progressively in their constitutions, even if the distances at each step from the lowest pitch to the highest differ by no significant amount, still their two limits will often differ greatly, in some cases towards the lower, in some towards the higher. But hearing grasps sounds still lower than the lowest and higher than the highest, to the extent that in the manufacture of instruments we can devise ways of increasing such distances. Ptol. *Harm.* 9.20–8

Thus when we establish a highest or a lowest note on instruments, our hearing grasps it, and allows us to understand that even if there were a higher or a lower, it grasps that too; and indeed, the variation in the height and depth of sounds | that actually reaches us runs out before our hearing does.³¹¹ For even if the sounds are produced from <things with> different constitutions and differ greatly, they still have limits in height and depth, just as if the differences they made were not great. The reason why Ptolemy says that the limit of hearing is greater than the limit of the sounds is that the limits of the sounds in respect of height and | depth are reached before the hearing fails, since it is always capable of grasping not only the high [80D]

³¹⁰ For the text and another translation of this fragment see Pearson (1990): 32–5.

³¹¹ I.e. the pitch range of sounds that we can actually make audible is smaller than the range that our hearing is capable of discriminating.

μένη οὐ μόνον τὰς ἐνεργεῖα ὑποπιπτούσας ὀξύτητας καὶ βαρύτητας, ἀλλὰ καὶ τὰς ἐννοουμένας παραυξήσεις.

- Ὁ μέντοι Ἀριστόξενος ἀληπτότερον οὐκ ἐπὶ τῶν ψόφων πεποι-
 (15) ται τὸν λόγον, ἀλλ' ἐπὶ τῆς φωνῆς, ἣν ἡμεῖς προΐεμεθα, τῷ λέγεσθαι
 τινας ψόφους ὑπερβάλλειν τὴν ἡμετέραν ἀκοὴν καὶ διὰ τοῦτο μὴ
 ἀκούεσθαι, ὥς ἐπιδείξομεν. οὐ μὴν ἀλλὰ καὶ περὶ τῆς ἡμετέρας φωνῆς
 καὶ ἀκοῆς ποιούμενος τὸν λόγον,
 ἐν μὲν τινι τῶν Συμμίκτων ὑπομνημάτων φησὶ τὸ μέ-
 γιστον καὶ ἐλάχιστον διάστημα ὑπεναντίως ἔχειν τῇ δυνάμει πρὸς τὴν
 (20) αἴσθησιν ἡμῶν. ἐπὶ μὲν γὰρ τὸ μέγα φθεγγόμενοι θᾶττον ἀπαγορεύομεν
 ἢ ἀκούοντες· ἐπὶ δὲ τὸ μικρὸν αἰσθανόμενοι πρότερον ἢ μελωδοῦντες.
 ἐν μέντοι τῷ πρώτῳ Περὶ ἀρχῶν φησιν, ὅτι “ἐπὶ μὲν τὸ μι-
 κρὸν ἅμα πῶς ἐξαδυνατεῖν εἴκασιν ἢ τε φωνὴ καὶ ἡ ἀκοή. οὕτε γὰρ ἡ
 (25) φωνὴ διέσεως ἐλαχίστης ἔλαττον δύναται διασαφεῖν, οὕθ' ἡ ἀκοὴ διαι-
 σθάνεσθαι, ὥστε καὶ ξυνιέναι, τί μέρος ἐστὶ εἴτε διέσεως, εἴτ' ἄλλου τινὸς
 τῶν γνωρίμων διαστημάτων. ἐπὶ δὲ τὸ μέγα τάχ' ἂν δόξειεν ὑπερτεί-
 νειν ἡ ἀκοὴ τὴν φωνήν, οὐ μέντοι πολλῷ γέ τι.”

- Τοιαῦτα μὲν καὶ τὰ τοῦ Ἀριστοξένου. εἰ μέντοι, ὥς φασιν οἱ Πυθαγό-
 (81) ρειοι, ἡ τοῦ παντὸς ἀρμονία διὰ μέγεθος ψόφων ὑπερβάλλει ἡμῶν τὴν
 ἀκοήν, μείζων ἂν εἴη ὁ ὅρος τῶν ψόφων τῶν τῆς ἀκοῆς. ἔχοι γὰρ ἂν
 καὶ ὀξύτάτους καὶ βαρυτάτους φθόγγους ἢ τοῦ παντὸς ἀρμονία, ὧν
 ἡμῶν ἡ ἀκοὴ ἀπολείπεται.
 (5) Γράφει οὖν ὁ Ἀρχύτας, οὗ καὶ πρόσθεν τὴν λέξιν παρεθήκαμεν
 περὶ τῶν ψόφων τάδε.

“Πολλοὺς μὲν δὴ αὐτῶν οὐκ εἶναι ἀμῶν τῇ φύσει οἶους τε γινώσκε-
 σθαι, τοὺς μὲν διὰ τὰν ἀσθένειαν τὰς πλαγᾶς, τοὺς δὲ διὰ τὸ μαῆκος τὰς

22 ἐπὶ Aristox. περὶ codd. post μὲν add. οὖν Aristox. μικρὸν Aristox. βαρύ codd. cf. 80.26 μέγα
 23 ἀδυνατεῖν G ἀκοή] αἴσθησις Aristox. 25 εἴτε om. g 26 ἐπὶ δέ] ἐπεὶ διὰ g 27 γε
 πολλῷ Aristox.

1 ὑπερβάλλειν G 2 ἔχει ET 7-11 apparatus in hoc fragmentum ad 56.16-21 supra reperitur

and low pitches that actually impinge on it, but also the further increases conceived by the mind.

Rather inexplicably, however, Aristoxenus did not apply this statement to sounds, but to the voice which we emit, in so far as he says | that some sounds exceed our hearing and are therefore not heard, as we shall show.³¹² It is true that while making our voice and hearing the topic of his discussion, he says in one of his *Miscellaneous Memoranda* that the largest and smallest intervals are opposite to our perceptive faculty | in their power. For when the interval becomes greater our voice gives out before our hearing, but when it becomes smaller our perception fails before our capacity to sing. In the first book of his *On Principles*, however, he says: 'When the interval becomes smaller the voice and the hearing seem to become ineffective at about the same time; for neither can the voice produce clearly any interval smaller than the smallest diesis,³¹³ nor can the hearing | discriminate it in such a way as to grasp what part it is either of a diesis or of any other of the recognisable intervals. But when it becomes larger the hearing would perhaps seem to extend beyond the voice, though not by much.'³¹⁴

These are the sorts of things Aristoxenus said. If, however, as the Pythagoreans say, the *harmonia* of the heavens exceeds our power of hearing because of the magnitude of the sounds, the limits of the sounds must be greater than those of the hearing; for the *harmonia* of the universe would contain both very high and very low notes which our hearing cannot detect.³¹⁵ | Thus Archytas, whose words we set out above (56.5–57.27), writes about sounds as follows: 'Many of these sounds are not capable of being discerned by our nature, some because of the weakness of the impact,

[81D]

³¹² Here as elsewhere, 'sounds' translates *psophoi* and 'voice' translates *phônē*. If my version is correct, Porphyry means that Aristoxenus makes the same claim as Ptolemy, except that he applies it only to the voice, and not to sounds in general; and Porphyry is using Aristoxenus' remark about sounds that are beyond the range of our hearing as evidence for his assertion. An alternative translation might read '... Aristoxenus did not make sounds the subject of his discussion, but the voice which we emit, by saying that ...' But in that case I do not understand what Porphyry intends.

³¹³ In Aristoxenus' writings the 'smallest diesis' is a quarter-tone.

³¹⁴ What Porphyry calls 'the first book of *On Principles*' seems to be identical with what we know as Book I of the *El. harm.* (cf. n. 318 below): the passage quoted appears, with minor textual variations, at *El. harm.* 14.18–28. In her edition of the *El. harm.* Da Rios includes the whole of Porphyry's paragraph as *test.* 43; the passage from the *Miscellaneous Memoranda* is fr. 128 Wehrli.

³¹⁵ This seems to be a misunderstanding of the passage of Archytas which Porphyry now quotes, where the 'magnitude' of the sounds is their volume, not their range of pitch (cf. also Aristotle *De caelo* 290b). Most accounts of the 'cosmic *harmonia*' (where *harmonia* corresponds roughly to 'musical scale') incorporate its elements within the bounds of the familiar two-octave system. Even the scale defining the structure of the World Soul in Plato's *Timaeus* has a span (four octaves and a minor sixth) well within the range to which human hearing extends, though it is larger than any used in practice by Greek musicians.

- ἀφ' ἁμῶν ἀποστάσιος, τινὰς δὲ καὶ διὰ τὰν ὑπερβολὰν τοῦ μεγέθους· οὐ
 (10) γὰρ παραδύεσθαι ἐς τὰν ἀκοὰν ἁμῖν τῷς μεγάλως τῶν ψόφων, ὥσπερ
 οὐδ' ἐς τὰ σύστομα τῶν τευχέων, ὅκκα πολὺ τις ἐκχέη, οὐδὲν ἐγχεῖται.”
 Ἀλλὰ περὶ μὲν τούτων ἀρκεῖτω ταῦτα. φανερόν δ' ἐκ τούτων, ὅτι
 αὕτη μὲν καθ' ἑαυτὴν ἢ τοῦ μέλους τάξις νοουμένη τὴν αὔξησιν ἐπ' ἀπει-
 (15) ρον ἂν δόξειε λαμβάνειν, εἰς μέντοι τὴν φωνὴν ἢ καὶ τὴν ἀκοὴν τιθεμένη,
 οὐκ ἐπ' ἀπειρον ἴσχει τὴν διάστασιν, ἀλλ' ὀρίζεται ὑπὸ τῆς ἡμετέρας
 δυνάμεως.

Τούτων τοίνυν οὕτως ἐχόντων διοριστέον ἐφεξῆς, ὅτι τῶν ψόφων
[10] οἱ μὲν εἰσιν ἰσότονοι, οἱ δὲ ἀνισότονοι. ἰσότονοι μὲν οἱ ἀπαράλλακτοι
κατὰ τὸν τόνον, ἀνισότονοι δὲ οἱ παραλλάσσοντες. ὁ γὰρ οὕτω λεγό-
μενος τόνος κοινὸν ἂν εἴη γένος τῆς ὀξύτητος καὶ τῆς βαρύτητος παρ'
ἐν εἶδος τὸ τῆς τάσεως εἰλημμένος, ὥς τὸ πέρας τοῦ τέλους καὶ τῆς
ἀρχῆς. [5]

- (18) Καταστήσας, τίνα τὰ κριτήρια τοῦ ἡρμοσμένου περὶ τε ὀξύτητος καὶ
 βαρύτητος τῶν ψόφων, καὶ διαλαβὼν ἐν τίνι γένει θεωροῦνται, περὶ φθόγ-
 (20) γων ποιεῖται τὸν λόγον, ἐπεὶ περ οὗτοι στοιχεῖα τοῦ μέλους ὥς τῆς ἐγ-
 γραμμάτου φωνῆς τὰ γράμματα, δεῖ δ' ἄρχεσθαι ἀπὸ τῶν στοιχείων.
 εἰώθασιν δὲ καὶ οἱ ἄλλοι ἀπὸ τούτων ἄρχεσθαι τῆς διδασκαλίας. διὸ καὶ
 αἰτιῶνται τὸν Ἀριστόξενον ἐν τοῖς Ἀρμονικαῖς στοιχείοις
 ἀπὸ τοῦ περὶ γενῶν λόγου καὶ οὐ τῶν φθόγγων τῆς διδασκαλίας
 (25) ἀρξάμενον. οἱ μὲν οὖν ἄλλοι πᾶσαν τάσιν τῶν ψόφων φθόγγους καλεῖν
 εἰώθασιν. οὗτος δ' ἀκριβέστερον οὐ πᾶσαν· γενικώτατον μὲν γὰρ εἶναι
 τὸν ψόφον, τούτου δ' εἶδος τι τὸν φθόγγον. τῶν γὰρ ψόφων οἱ μὲν
 εἰσιν ἰσότονοι, οἱ δ' ἀνισότονοι. δεῖ δὲ πρότερον περὶ τῶν κατὰ τὸν
 τόνον σημαινόμενων εἰπεῖν πρὸς τὸ δηλὸν γενέσθαι, ποῖον εἴληπται
 (30) σημαινόμενον, ὅταν λέγωμεν ἰσότονον ἢ ἀνισότονον.

19 θεωρεῖται g

22 οἱ om. p

24 ante γενῶν add. τῶν g

25 ψόφων] φθόγγων Tg

some because of the extent of the distance from us, and some even because of their excessive magnitude. For | large sounds do not slip into the ear, just as nothing enters the narrow neck of a vessel when one pours out a large quantity.'

But let that be enough on these matters. It is clear from these remarks that when the ordering³¹⁶ of melody is conceived in itself it would seem to be able to increase without limit, but when accommodated to the voice and to hearing | it does not have extension without limit, but is bounded by our own powers.

Then given that these things are so, it must next be explained that some sounds are equal-toned and some unequal-toned. Equal-toned sounds are those that do not change in respect of tone (*tonos*), unequal-toned sounds those that do change. What is called 'tone' in this sense must be a genus common to both height and depth, understood in relation to one form, that of pitch, as limit is common to both end and beginning. Ptol. *Harm.* 9.29–10.5

Now that Ptolemy has established the criterion of that which is attuned in respect of the height and depth of sounds, and has identified the class to which they should be conceived as belonging, he provides | a discussion of notes, since these are the elements of melody, as the letters are the elements of the kind of voice that can be written,³¹⁷ and one must begin from the elements. The other writers too have usually begun their teaching from them. Hence they criticise Aristoxenus for beginning his teaching in the *Harmonic Elements* from a discussion of the genera and not of the notes.³¹⁸ | Now the others usually give the name 'notes' to all pitches of sounds. But Ptolemy, more accurately, does not give it to all, on the grounds that sound is the most generic class, and that the note is a species of it; for some sounds are equal-toned and others unequal-toned. As a preliminary we must speak about the things signified by the term *tonos* ('tone'), so that it becomes clear which | signification is being used when we say 'equal-toned' or 'unequal-toned'.

³¹⁶ The noun is *taxis*, usually referring in such contexts to the way in which a scale or similar structure is organised. Here it perhaps designates a well-ordered scalar series of intervals.

³¹⁷ The word *grammata*, 'letters', is often used of the articulate sounds which the written letters represent. Porphyry is comparing the elements of melody with those of speech, not those of a written text.

³¹⁸ What Porphyry calls the *Harmonic Elements* is (or at least begins with) what we know as Book 2 of the *El. harm.*, whose initial programme identifies the genera as the first subject for study at 34.30–35.25. After some further preliminaries, it is indeed the first topic discussed (it is briefly introduced at 44.21–6; its full-scale treatment begins at 46.19). Cf. n. 314 above, and Barker (2007): 134–5.

- (82) Τρία γὰρ σημαίνεται ἐκ τῆς “τόνος” λέξεως ἐν μουσικῇ. τόνος γὰρ λέγεται καὶ τὸ διάστημα, οἷον μέτρον τι τοῦ τῆς φωνῆς τόπου, καθ’ ὃ λέγεται μείζον εἶναι τὸ διὰ πέντε τοῦ διὰ τεσσάρων τόνων· λέγεται δὲ τόνος καὶ ὁ κατὰ τὸ σύστημα τόπος κατ’ Ἀριστόξενον δεκτικὸς ὧν τελείου συστήματος ἀπλατῆς, ὡς λέγεται ὁ Δῶριος καὶ ὁ Φρύγιος καὶ οἱ παραπλήσιοι τρόποι. ἐκ τρίτων δὲ λέγεται τόνος καὶ ἡ τάσις αὐτῇ, ὅθεν φαμέν τῶν μελωδούντων τοὺς μὲν ὀξεῖ, τοὺς δὲ βαρεῖ τόνω χρησθαι. τόνος οὖν εἴληπται ἐν τῷ λέγειν ἰσότονον καὶ ἀνισότονον ὁ ἐπὶ τῆς τάσεως τεταγμένος κοινός· κοινὴ δ’ ἡ τάσις ὀξύτητος καὶ βαρύτητος καὶ ὁ παρὰ ταύτην λεγόμενος κοινὸς ὀξύτητος καὶ βαρύτητος, ὡς καὶ τὸ πέρας κοινὸν τέλους καὶ ἀρχῆς καὶ τὸ χρῶμα λευκοῦ καὶ μέλανος γένος. κατηγορεῖται γὰρ ἡ τάσις ἀμφοῖν· ἔστι γὰρ καὶ ἡ βαρύτης τάσις καὶ ἡ ὀξύτης τάσις, οὔτε δ’ ἡ βαρύτης ἐστὶν ἐν ὀξύτητι, οὐθ’ ἡ ὀξύτης ἐν βαρύτητι, ἀλλ’ ἐν τάσει μόνον.
- (15) Δήλου τοίνυν γεγονότος, τίς τόνος παραλαμβάνεται ἐν τῷ λέγειν ἰσότονον καὶ ἀνισότονον, ῥητέον πάλιν, ὡς ἰσότονος ὁ ψόφος λέγεται διχῶς. ὁ μὲν ἄλλω ψόφῳ ἴσην τὴν τάσιν κεκτημένος ὥσπερ ἡ νῆτη συνημμένων τῇ παρανήτῃ διεzeugμένων λέγεται εἶναι ἰσότονος. τὸν δ’ οὕτως ἰσότονον ψόφον κυριώτερον ὁμότονον καλοῦσι καὶ οὐ ψόφον ἀπλῶς, ἀλλ’ ὁμότονον φθόγγον, ἐν μὲν οὖν τοῦτο σημαίνόμενον τοῦ ἰσοτόνου, ἕτερον δὲ τὸ ἐφ’ ἑνὸς καὶ ταυτοῦ τιθέμενον καὶ οὐ πρὸς ἕτερον ψόφον ἀναφέρον τὴν ἰσότητα, πρὸς δὲ τὰ ἑαυτοῦ μέρη. ἔχει γὰρ πᾶς ψόφος, κἂν ἀπλούστατος ἢ καὶ ἀρχοειδέστατος ἀρχὴν τε καὶ μέσα καὶ τελευτήν· οὐ γὰρ ἐστὶν ἀδιάστατος, ἐπεὶ οὐδ’ ἂν προσέπιπτε τῇ ἀκοῇ. ἐπεὶ οὖν ἐστὶν ὁ ψόφος

2 καὶ] κατὰ p 3 τόνω scripsi <τόνου> λόγῳ Düring λόγου G λόγῳ ceteri 6 τρίτων] τριῶν
 MEV¹⁸⁷ p τούτων G 8 ἰσότερον καὶ ἀνισότερον T 9 post κοινός add. τόνος A 10 καὶ^{prim.}
 – βαρύτητος om. g 16 ἰσότονος scripsi ἰσότονον Düring 23 μέσα] μέσην T

Three items are signified by the expression *tonos* in musical discourse.³¹⁹ First, *tonos* designates an interval, as the unit of measurement for the range of the voice; thus it is said that the fifth is greater than the fourth by a *tonos*. *Tonos* also designates the range³²⁰ of a scale, according to Aristoxenus a range with no breadth, capable of receiving | a complete scale³²¹ such as the Dorian and the Phrygian and similar *tropoi*.³²² Thirdly, pitch itself is called *tonos*, and hence we say that some singers use a high *tonos* and others a low one. The *tonos* involved in saying ‘equal-toned’ (*isotonos*) and ‘unequal-toned’ (*anisotonos*) is the one assigned as common to pitch;³²³ pitch is common to height and | depth, and the *tonos* designating pitch is also common to height and depth, just as limit is common to end and beginning, and colour is the genus of white and black. For pitch is predicated of both of them, since depth is pitch and height is pitch too, although depth is not in height or height in depth, but only in pitch.

| Now that it has become clear which *tonos* is involved in speaking of the equal-toned and the unequal-toned, we must say, furthermore, that a sound is said to be equal-toned in two ways. A sound whose pitch is equal to that of another, as is *nētē synēmmenōn* to *paranētē diezeugmenōn*, is said to be equal-toned.³²⁴ But an equal-toned sound in this sense is more properly called ‘homotone’, and not merely a homotone sound but a homotone | note.³²⁵ This, then, is one signification of ‘equal-toned’. The other is the one assigned to one and the same sound, and does not specify equality in relation to another sound but in relation to its own parts. For every sound, even the simplest and most elementary, has a beginning, a middle and an end; for it is not indivisible, since then it would not even impinge

³¹⁹ The same three-part distinction appears at Arist. Quint. 20.1–4. Cleonides (202.6–8 Jan, with discussion continuing to 204.18) adds a fourth sense, in which *tonos* is equivalent to *phthonggos*, ‘note’. But the passage he cites as evidence for this sense is not persuasive; it does not include the noun *tonos*, only the compound adjective *heptatonos*. I know of no text in which the noun itself has the meaning ‘note’.

³²⁰ Literally ‘place’, *topos*; the allusion is to the pitch-range or tessitura of a scale in a given *tonos*, where *tonos* is roughly equivalent to the modern ‘key’.

³²¹ That is, an instance of the two-octave Complete or Perfect System, within which examples of all acceptable melodic relations can be found. This definition of a *tonos*, and in particular its description of the ‘range’ (*topos*) as having no breadth (*aplatēs*), does not appear in our texts of Aristoxenus, but cf. Cleon. *Harm.* 180.4–5 Jan.

³²² In writings of this period, *tropos* is a common variant for *tonos* in the sense under discussion.

³²³ I.e. the one applied to pitch in general, or to any pitch regardless of its height or depth.

³²⁴ The highest note of a tetrachord conjoined at *mesē* with the tetrachord *hypatōn*, called *nētē synēmmenōn*, has the same pitch as the second-highest note of a tetrachord disjoined above *mesē* from the tetrachord *hypatōn* (this is *paranētē diezeugmenōn*), so long as that tetrachord is in the standard form of the diatonic genus.

³²⁵ ‘Homotone’ renders *homotonos*, literally ‘with the same pitch’. Such relations are more usually expressed by the adjective *homophōnos*, ‘homophone’ or ‘in unison’.

- (25) ἐν παρατάσει, συμβέβηκε τὸν μὲν τινα δι' ὅλου ὁμοιον εἶναι καὶ κατὰ τὴν ἀρχὴν καὶ κατὰ τὰ μέσα καὶ κατὰ τὸ τέλος. καλεῖται οὖν οὗτος ἰσότονος, ὃν ἂν εἴπῃς κυριώτερον ὁμοιομερῆ· κυριώτερον δ' ἔφην ὁμοιομερῆ καλεῖσθαι, ὅτι τὸ ὁμοιον ποιοῦ οἰκεῖον, τὸ δ' ἴσον ποσοῦ. προειληφότες δ' οὗτοι τὴν τάσιν τῆς φωνῆς ποσότητα τοῖς τοῦ ποσοῦ σημαντικοῖς χρώνται ἐπ' αὐτῆς. ἰσότονος μὲν οὖν ὁ τοιοῦτος καλεῖσθω ψόφος, ὧ ἐναντίος ὁ ἀνισότονος ὁ μὴ ὁμοιομερῆς, μηδὲ δι' ὅλου ὁμοιος ὢν, ἀλλὰ κατὰ τι τῶν μερῶν παραλλάσσων τῶν ἑαυτοῦ. αὕτη μὲν δὴ πρώτη διαίρεσις τῶν ψόφων· ἐν τίνι δὲ θετέον τοὺς φθόγγους, προϊὼν διδάξει.
- (30) **τῶν δὲ ἀνισοτόνων οἱ μὲν εἰσι συνεχεῖς, οἱ δὲ διωρισμένοι, [5]**
συνεχεῖς μὲν οἱ τοὺς τόπους τῶν ἐφ' ἑκάτερα μεταβάσεων ἀνεπιδήλους ἔχοντες ἢ ὧν μηδ' ὅτιοῦν μέρος ἰσότονόν ἐστιν ἐπὶ διάστασιν αἰσθη-
τῇν, ὅποῖον πέπονθε τὰ τῆς ἱριδος χρώματα. τοιοῦτοι δὲ εἰσιν οἱ
ταῖς ἐπιτάσεσιν αὐταῖς ἢ ταῖς ἀνέσεσι κινουμέναις ἔτι συνηχοῦντες,
καὶ πάλιν ἐπὶ τὸ βαρύτερον οἱ βουκανισμοὶ λήγοντες, ἐπὶ δὲ τὸ ὀξύτερον [10]
οἱ τῶν λύκων ὠρυγμοί.
- (2) Συνεχές ἐστὶ μέγεθος, οὗ λαβεῖν ἐστὶ κοινὸν ὄρον, πρὸς ὃν τὰ μόρια αὐτοῦ συνάπτει, οἷον ἡ γραμμὴ. ἔστι γὰρ ἐπ' αὐτῆς λαβεῖν τὴν στιγμὴν κοινὸν ὄρον, πρὸς ἣν τὰ μόρια τῆς γραμμῆς συνάπτει. ὁμοίως δὲ καὶ ἡ
- (5) ἐπιφάνεια συνεχές ἐστὶ μέγεθος· τὰ γὰρ τοῦ ἐπιπέδου μόρια πρὸς τὴν γραμμὴν ὡς κοινὸν ὄρον συνάπτει. διωρισμένον δ' ἐστίν, οὗ οὐδεὶς ἐστὶ κοινὸς ὄρος, πρὸς ὃν συνάπτει αὐτοῦ τὰ μόρια, οἷον ὁ ἀριθμὸς. ὁ γὰρ πέντε, εἴ ἐστὶ τῶν δέκα μόριον, πρὸς οὐδένα κοινὸν ὄρον συνάπτει τὰ πέντε καὶ τὰ πέντε, ἀλλὰ διώριστα· οὐδ' ἂν ἔχοις ὅλως ἐπ' ἀριθμοῦ
- (10) λαβεῖν κοινὸν ὄρον τῶν μορίων, ἀλλ' αἰεὶ διώριστα. τοιοῦτου τοίνυν ὄντος τοῦ συνεχοῦς καὶ τοῦ διωρισμένου τῶν ἀνισοτόνων ψόφων οἱ μὲν φησὶν εἰσι συνεχεῖς, οἱ δὲ διωρισμένοι. περὶ μὲν οὖν τῶν διωρισμένων ἀνισοτόνων ψόφων ῥηθήσεται ὕστερον, νῦν δὲ περὶ τῶν συνεχῶν ἀνισοτόνων ψόφων λέγωμεν· εἰσὶ γὰρ πρὸς τὸ ἡρμοσμένον ἀνεπιτήδαιοι, οὐδὲ
- (15) τῆς τῶν φθόγγων καταξιούμενοι προσηγορίας. ἐὰν τοίνυν αὐτοὺς ἐμφανίσωμεν οἵτινές εἰσι, τότε καὶ τοὺς ὄρους αὐτῶν εἰσόμεθα, εἰ ὁρθῶς

9 τὰ om. M οὐδ' —
 14 ψόφων om. T

10 διώριστα om. G ἐπ'] ἀπ' Tg

12 μὲν om. g

13 ῥηθήσεται —

on the hearing. Then since sound | involves extension, one kind of sound is alike throughout, at the beginning, in the middle parts, and at the end. This sound is called equal-toned, though you would more properly call it homoeomerous;³²⁶ I said that it is more properly called homoeomerous because likeness (*to homoion*) belongs to quality, and equality to quantity. It is because these people presuppose that the pitch of the voice is a quantity that they use words signifying quantity | to describe it. At any rate, let this sort of sound be called equal-toned; and its opposite, the unequal-toned, is that which is not homoeomerous and is not alike throughout, but is different somewhere among its own parts. This, then, is the first division of sounds. As he proceeds, Ptolemy will explain in which class the notes are to be placed.

Some unequal-toned sounds are continuous, some discontinuous, the continuous being those the locations of whose movements in each direction are not clearly apparent, or of which no single part is equal-toned over a perceptible interval <of time>, as with what happens to the colours of the rainbow. Of this sort are the sounds that accompany the actual movements of tensing or relaxing,³²⁷ or again, in a downwards direction, the lowing of cattle as it dies away, and in an upwards direction the howling of wolves. Ptol. *Harm.* 10.5–11

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A continuous magnitude is one in which it is possible to find a common boundary at which its parts meet, for example a line. For on a line one can take the point as the common boundary at which the line's parts meet. In the same way a | surface is a continuous magnitude, since the parts of a plane meet a line as their common boundary. A discontinuous magnitude is one in which there is no common boundary at which its parts meet, for example a number. For 5, when it is part of 10, does not make the 5 and the 5 meet at any common boundary, but they are separated; nor could you ever | find a common boundary for the parts of a number, but they are always separated.

Given that the continuous and the discontinuous are of that sort, he says that some unequal-toned sounds are continuous and some discontinuous.³²⁸ We shall speak later of discontinuous unequal-toned sounds, but for now let us discuss continuous unequal-toned sounds; for they are unsuitable for attunement, and do not | deserve the title 'notes'. If, then, we explain which they are, we shall know whether their definitions

³²⁶ That is, 'composed of parts that are all alike'.

³²⁷ That is, when tensing or slackening a string during the process of tuning.

³²⁸ On the passage from here to 84.28 see Introduction Section 5(d).

- ἀποδέδονται. ἀνισότονοι γάρ εἰσι συνεχεῖς ψόφοι, ὧν οὐχ ὁμοία γίνεται οὐδ' ἴση ἡ τάσις, οὐδ' ὁμοιομερής, οἷος ὁ τῶν τυπτομένων χαλκωμάτων ψόφος καὶ ὁ τῶν σαλπίγγων τῶν ὠρολογίων ἤχος. ταῦτα γὰρ ἀρχόμενα
- (20) κατ' ὀλίγον ἐπαναβαίνει καὶ συνεχῶς καὶ κατ' ὀλίγον ἐπιτεινόμενα ἔτερα καὶ ἔτερα, καὶ ἑτέραν ποιεῖται τάσιν, συνεχῇ μέντοι. ἀνερχόμενα δὲ ἐφ' ἣν πέφυκεν ἄρχεσθαι, πάλιν ἐκ τοῦ κατ' ὀλίγον ὑποβαίνοντα μουρίζεται, καὶ πρὸς τὸν βαρύτερον ἀφικνούμενα τόπον οἰονεῖ καθ' ὑπέκλυσιν μόγισ ἀποσιωπᾶ.
- (25) Κάπτι τῶν ἄρτι δὲ μανθανόντων μελωδεῖν τὸ αὐτὸ συμβαίνει· προβαλλομένου γάρ τινα τάσιν τοῦ διδασκάλου καὶ κελεύσαντος ταύτην ὁμοίως προενέγκασθαι ὁ μανθάνων πειρώμενος μὲν ὁμοτονεῖν, οὐ δυνάμενος δέ, προφέρεται τινα τάσιν βαρυτέραν τῆς δοθείσης καὶ ὀξυτέραν, καὶ λοιπὸν ἀντιλαμβανόμενος ἑαυτοῦ μὴ λήγοντος σιωπῆσαι μὲν αἰδεῖται, μένων δ'
- (30) ἐν τῷ φωνῇ ἀφιέναι οἰονεῖ διαψηλαφᾶ καὶ ζητεῖ πάντα τὸν σύνεγγυς
- (84) τόπον τῆς ἐνδοθείσης τάσεως· καὶ βαρυτέρας μὲν τῆς ἰδίας προφορᾶς αἰσθησιν λαβὼν παροξύνει κατ' ὀλίγον αἰσθητὸν διάστημα μὴδ' ἐν ποιῶν· ὀξυτέρας δέ, βαρύνει πάλιν πρὸς ὀλίγον. ταῦτα δὲ ποιῶν συνεχῇ μὲν τὴν τάσιν τῆς φωνῆς ποιεῖ, ἐπὶ μίαν δὲ καὶ ὁμοίαν καὶ ἴσην τάσιν οὐκέτι,
- (5) οὐδ' ἰσοτόνως.
- Ἰδεῖν δ' ἐστὶ τοῦτο κάπτι τῶν ἐντατῶν ὀργάνων, ἐφ' ὧν, ὅταν τις ἅμα τῷ πληξαί τινα χορδὴν εὐθύς ἐπιτείνῃ, ποιεῖ φωνὴν κατὰ παρεξήγησιν ἑτέραν. σχεδὸν γὰρ τῆς πληγῆς ἔτι συνεχούσης τὸν φθόγγον ἐπακολουθήσασα καὶ ἡ ἐπίτασις ἢ ἄνεσις ὑποσύρει τοῦτον εἰς ἀπείρους καὶ συνε-
- (10) χεῖς τάσεις. ὃ δὴ ἔφη καὶ ὁ Πτολεμαῖος πεπονθέναι τοὺς ταῖς ἐπιτάσεσιν ἢ ταῖς ἀνέσεσιν κινουμέναις ἔτι συνηχοῦντας ψόφους.
- “Ἔστι δ' ἐπίτασις μὲν κίνησις φωνῆς ἐκ βαρυτέρου τόνου εἰς ὀξύτερον, ἄνεσις δὲ κίνησις φωνῆς συνεχῆς ἐξ ὀξυτέρου εἰς βαρύτερον, τάσις δὲ μονὴ καὶ στάσις τῆς φωνῆς. καὶ βαρύτης μὲν φωνῆς ἐστὶ τὸ γινό-

21 καὶ ἔτερα m.a. M ἀνερχόμενα Alexanderson ἀρχόμενα codd. 28 προφέρεται m

29 λήγοντος Wallis λέγοντος codd. μένων Düring μόνον codd.

in lemmate: 10.7 μηδ' οὐδ' ΜΕρ 10 ante τό^{prim.} add. μέν ΜΕρ δικανισμοί ss. m. pr. βυ- M

1 ἐκδοθείσης Tg 6 ante ἰδεῖν add. ὁ T ἐνθα τῶν p ὧν] ῶ p 7 παρεξήγησιν p

8 συνεχούς p 9 ὑποσείρει p 10 ante ἔφη add. καὶ g 13 συνεχῆς Düring συνεχούς codd.

14 τῆς om. m φωνῆς^{sec.} om. g

have been expressed correctly. Unequal-toned continuous sounds are those whose pitch is not equal or alike or homoeomerous, sounds like that of pieces of bronze being beaten, or the resonances (*ēchoi*) of the trumpets that sound the hours.³²⁹ For when these are beginning | they gradually ascend, and as they become continuously and gradually more tense³³⁰ they become different and different again, and make the pitch different but nevertheless continuous.³³¹ But when they are returning towards their natural starting-point, they gradually tail away³³² as they descend again, and when they arrive in the lower region they become feebler, as it were, and slide wearily into silence.

| The same thing happens with people who are just learning to sing. For when the teacher produces a particular pitch and tells them to produce it in the same way, the pupil who is trying to sing the same pitch,³³³ but cannot, produces some pitch lower than the one given, and a higher one; and then becoming aware of himself, without stopping, he is ashamed to fall silent, and while continuing | to give voice he gropes about, as it were, and seeks out every region near the given pitch. When he perceives that his own utterance is too low he gradually sharpens it, without producing a single perceptible interval, and when he perceives that it is too high, he again gradually makes it lower. As he does these things he makes the pitch of the voice continuous, never settling on a pitch that is one and the same and equal, | and never equal-toned.

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One can see this also on stringed instruments, on which, when someone strikes a string and at the same time immediately tightens it, it makes a voice that becomes progressively different.³³⁴ For while the impact is still making the note continuous, the subsequent tightening or slackening drags the note into an unlimited number of continuous | pitches. This is what Ptolemy says is done to sounds by tightenings and slackenings that change while the sounds are still continuously resounding. 'Tensing is the movement of the voice from a lower tone (*tonos*) to a higher one, and slackening is the continuous movement of the voice from a higher to a lower; and pitch is the motionless standstill of the voice. Depth of the

³²⁹ Clocks equipped with water-powered 'trumpets' (*bucinae*) are among the inventions attributed to Ctesibius of Alexandria by Vitruvius (IX.8.5).

³³⁰ I.e. higher in pitch.

³³¹ That is, the sound shifts smoothly through an unbroken continuum of pitch.

³³² The metaphor in Greek is based on the tapering shape of a mouse's tail.

³³³ The verb is *homotontin*, 'to produce a homotonous note'.

³³⁴ The word 'progressively' is a guess at the sense of *kata parexēgēsīn*. The noun *parexēgēsis* appears elsewhere only in later writings, where it regularly refers to a written explication or interpretation of a text, and there seems to be no parallel to the usage involved here. The variant found in one group of MSS, *parexētēsis*, is otherwise unknown.

- (15) μενον διὰ τῆς ἀνέσεως, ὀξύτης δὲ τὸ γινόμενον διὰ τῆς ἐπιτάσεως.”
 Ἡ τάσις δέ, ὡς ἥδη ἀποδέδεικται, ὀξύτητος καὶ βαρύτητος διαφέρει, ἢ γένος εἰδῶν. διὸ κοινὴ ἐστὶν ἐκατέρας ἐναντίων οὐσῶν ἀλλήλαις. ἔχουσι μὲν τοίνυν οἱ ἀνισότονοι ψόφοι μετάβασιν, ἀλλ’ ἀνεπίδηλον ταύτην τῷ μὴ διορίζεσθαι τοὺς τόπους αὐτῆς, ὥστ’ ὀρθῶς ἀπεδόθησαν “συνε-
 (20) χεῖς εἰσιν οἱ ἀνισότονοι ψόφοι, οἱ τοὺς τόπους τῶν ἐφ’ ἐκάτερα μεταβάσεων ἀνεπιδήλους ἔχοντες”. ἔστι δὲ καὶ οὕτως αὐτοὺς ἀφορίσαι, “ὧν οὐδ’ ὅτιοῦν μέρος ἰσότονόν ἐστιν ἐπὶ διάστασιν αἰσθητήν”. μέρος μὲν γάρ τί ἐστιν ἐν αὐτοῖς ἰσότονον, ἀλλ’ ἄχρι τινός, μέρος δ’ ἀνισότονον, οὐ μὴν ἐπιδηλώσοι ἂν οὐ συνεχῆς ὁ ψόφος ἀλλὰ διωρισμένος, διειλημμένων αὐ-
 (25) τοῦ τῶν τάσεων τοῖς ἐπιδήλοις πέρασιν. ὥσπερ οὖν ἐπὶ τῆς ἱριδος τὸ πρασίζον χρῶμα καὶ τὸ χρυσίζον καὶ ἐρυθρόν ἄχρι μὲν τινος ὅμοιον θεωρεῖται, ἀνεπίδηλον δὲ τὸ πέρας ἐκάστου καὶ συγκέχυται ἀκαταλήπτως τῇ αἰσθήσει· οὕτως ἐπὶ τῶν ἀνισοτόνων συνεχῶν ψόφων ἔχει· καὶ τᾶλλα δ’ ἃ παρείληφε παραδείγματα εἰσηγησόμεθα.

διωρισμένοι δὲ εἰσιν οἱ τοὺς τόπους τῶν μεταβάσεων ἐκδήλους ἔχοντες, ὅταν αὐτῶν ἰσότονα μέρη τὰ μέρη ἐπὶ διάστασιν αἰσθητήν, ὡς ἐπὶ τῆς διαφόρου παραθέσεως τῶν ἀκράτων τε καὶ ἀσυγχύτων χρωμάτων.

- (85) Διωρισμένους ἀνισοτόνους ψόφους φησὶν εἶναι, ὅταν οἱ τόποι τῶν μεταβάσεων εἰσιν ἔκδηλοι καὶ μὴ συγκεχυμένοι. γίνεται δὲ τοῦτο, ὅταν ἰσότονα μέρη αὐτῶν τὰ μέρη δι’ αἰσθητήν τάσιν. ἡ γὰρ διορίζουσα τάσις τὰ πέρατα τῶν μερῶν, ὅταν ἢ αἰσθητὴ καὶ μὴ ἀνεπίδηλος, τὸ ἀνισότονον
 (5) αὐτῶν μερίζουσα τῇ αἰσθητῇ διαφορᾷ, ἐκδήλους ποιεῖ τὰς μεταβάσεις, καὶ διὰ σιγῆς ἢ φωνῆ μὴ διακόπτεται. οὐ γὰρ διωρισμένοι εἰσὶ ψόφοι οἱ σιγαῖς διειλημμένοι, ἀλλ’ οἱ τὰς ὀξύτητας καὶ βαρύτητας περιγεγραμμένας ἔχοντες καὶ ἀσυγχύτους, καθάπερ ἄκρατα χρώματα ἀλλήλοις παρακείμενα. διὰ τοίνυν τὸ ἀφωρίσθαι τὰς τάσεις, καὶ ὑφ’ ἐν πνεῦμά
 (10) τις προσφέρῃ αὐτοὺς μὴ διακόπτων, διωρισμένοι λέγονται· καὶ ἀνισότο-

20 οἱ] ^{sec.} οὐ M ante μεταβάσεων add. τῶν g 21 οὐδ’ om. m 22 τι] τις m 24 <ὧν>
 post συνεχῆς fortasse addendum 29 ἐξηγησάμεθα G

9 ἀφωρεῖσθαι m

voice is what comes about | through slackening, and height is what comes about through tensing.³³⁵

Pitch, as has already been explained, differs from height and depth as genus from species; and hence it is common to both, though they are one another's opposites. Unequal-toned sounds, then, do make transitions, but they are imperceptible because their locations are not distinctly defined. Thus it is rightly said that | unequal-toned continuous sounds are 'those the locations of whose movements in each direction are not clearly apparent'. It is possible also to define them in this way, as those 'of which no single part is equal-toned over a perceptible interval <of time>'.³³⁶ For there is in them a part which is equal-toned, but only up to some point, and a part which is unequal-toned, but a sound would not make this³³⁷ apparent if it were not continuous but discontinuous, | with pitches separated by clearly apparent boundaries. Thus just as in the rainbow the green colour and the golden and the red are seen as the same up to some point, but the boundary of each is not clearly apparent and is blurred in a way that perception cannot grasp, so it is with unequal-toned continuous sounds. We shall also introduce the other examples that Ptolemy appends.

| Discontinuous sounds are those the locations of whose movements are clearly apparent, when their parts remain equal-toned over a perceptible interval <of time>, as in the juxtaposition of different colours that are unmixed and have not run together. Ptol. *Harm.* 10.11–14

He says that there are discontinuous unequal-toned sounds when the locations of the transitions are apparent and not blurred. This happens when their parts remain equal-toned at a perceptible pitch. For the pitch that distinguishes the boundaries of the parts, when it is perceptible and not undetectable, divides their inequality of tone | by a perceptible difference and makes the transitions apparent, even if the voice is not chopped up by silence. For discontinuous sounds are not those divided by silences,³³⁸ but those whose high and low pitches are circumscribed and un-blurred, like pure colours lying side by side. Thus it is because the pitches are made distinct, even if one | produces them on a single breath without chopping

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³³⁵ Quoted from Aristox. *El. harm.* 10.24–9, with minor textual variations.

³³⁶ The quotations are from the passage currently under discussion, Ptol. *Harm.* 10.6–8.

³³⁷ 'This' is the unequal-toned part, the phase of the sound made up of an unbroken glissando between pitches. A continuous sound presents its unequal-toned phases to the hearing, making them perceptible, whereas every perceptible phase of a discontinuous sound is equal-toned.

³³⁸ Contrast the position attributed at 10.12–16 to the Aristoxenians (but not – or not explicitly – to Aristoxenus himself, who would have denied it).

νοι μέν, ὡς πρὸς ἀλλήλας αἱ τάσεις θεωροῦνται, καθ' ἑαυτὴν δ' ἐκάστη καὶ τὰ ἑαυτῆς μέρη ἰσότονοι, ὥσθ' ἐκάστην διάληψιν τῶν διωρισμένων ἀνισοτόνων ψόφων καθ' ἑαυτοὺς μέν ἀποτελεῖν αὐτοὺς ἰσοτόνους, πρὸς δ' ἀλλήλους ἀναφερομένους ἀνισοτόνους.

**ἀλλ' ἐκείνοι μὲν ἀρμονικῆς ἀλλότριοι μηδαμῇ
μηθὲν ὑποβάλλοντες ἐν καὶ ταύτόν, ὥστε μήτε ὄρω μήτε λόγῳ περιλη- [15]
φθῆναι δύνασθαι παρὰ τὸ τῶν ἐπιστημῶν ἴδιον, οὗτοι δὲ οἰκείοι, τοῖς
μὲν πέρασι τῶν ἰσοτονιῶν ὀριζόμενοι, παραμετρούμενοι δὲ ταῖς τάξεσι
τῶν ὑπεροχῶν.**

- (16) Τῶν ἀνισοτόνων ψόφων οἱ μὲν ἦσαν συνεχεῖς, οἱ δὲ διωρισμένοι. τοὺς μὲν οὖν συνεχεῖς παρητητέον φησὶ διὰ τὸ εἶναι ἀορίστους καὶ ἀπείρους καὶ διὰ τοῦτο πάσης τεχνικῆς ἐκκλείεσθαι καταλήψεως—τῶν γὰρ ἀπείρων καὶ ἀορίστων ὠμολόγηται μὴ εἶναι ἐπιστήμην—τοὺς δ' ἀνισοτό-
(20) νους μέν, διωρισμένους δ', οὐ. κατὰ τὸν διορισμὸν εἴ τις σκοπός, οἱ αὐτοὶ ἔσονται τοῖς ἰσοτόνοις ὅμοιοι ὄντες ἑαυτοῖς, εἰ καὶ ἀλλήλοις ἀνόμοιοι. τούτους οὖν φησι ληπτέον ὡς οἰκείους τῇ ἀρμονικῇ. διὸ γὰρ φησι τοὺς ἀνισοτόνους συνεχεῖς παρητούμεθα ὡς ὄντας ἀπείρους καὶ ἀπεριορίστους καὶ διὰ τοῦτο τῶν ἐπιστημῶν ἀλλοτρίους· ἔμπαλιν τούτους παραδε-
(25) κτέον· ὀρίζονται γὰρ καὶ τοῖς πέρασι τοῖς οἰκείοις, ἃ δὴ ἐστὶν ἰσότονα τοῖς ὅλοις, παραμετροῦνται δὲ καὶ ταῖς τάξεσι τῶν ὑπεροχῶν. ὑπεροχῶν δὲ τάξεις εἰσὶ, καθ' ἃς οἱ τῶν ἀριθμῶν λόγοι θεωροῦνται οἳ τε πολλαπλά-

11 ἀλλήλους αἱ (lacuna) καθ' p τάσεις θεωροῦνται om. g 13 ante καθ' add. καὶ g
14 φερομένους G 20 οὐ] οὐς Wifstrand σκοπός] σκοποὶ Wifstrand 25 ὀρίζεται m

them up, that they are called discontinuous; and they are unequal-toned in so far as the pitches are considered in relation to one another, though each pitch is equal-toned in itself and its own parts. Hence each division of discontinuous unequal-toned sounds results in their being equal-toned, but when related to one another they are unequal-toned.³³⁹

| But the former [i.e. continuous unequal-toned sounds] are foreign to harmonics, never providing anything that is one and the same, so that contrary to what is proper to the sciences, they cannot be circumscribed by a boundary or a ratio; while the latter [i.e. discontinuous unequal-toned sounds] are at home in harmonics, being bounded by the limits of the equal-toned parts, and measured against one another by the ranking orders of their excesses. Ptol. *Harm.* 10.14–18

Some unequal-toned sounds were said to be continuous and others discontinuous. Ptolemy says, then, that one should reject the continuous ones because they are indeterminate and indefinite and for that reason are excluded from technical cognition³⁴⁰ – for it was agreed that there is no scientific knowledge of things that are indefinite and indeterminate – but should not reject those that are unequal-toned | but discontinuous. If one focuses on the discontinuity,³⁴¹ they will be the same as equal-toned sounds, since they are similar to themselves, even though they are dissimilar to one another. These, he says, should be adopted as appropriate to harmonics. That is why he says that we reject unequal-toned continuous sounds as being indefinite and un-circumscribed and therefore alien to the sciences, and that the others, conversely, should be accepted. | For they are bounded by their own proper limits, which are equal in tone to the wholes,³⁴² and they are measured against one another by the ranking orders of their excesses.³⁴³ The ranking orders of the excesses are those to which the ratios of numbers correspond, the multiple, the epimoric

³³⁹ Porphyry's expression in this sentence is rather awkward, but the intended sense is clear; he is in effect repeating what he said in the previous sentence.

³⁴⁰ 'Technical cognition' is a clumsy attempt to render the phrase *technikē katalēpsis*. In Porphyry's usage it is apparently equivalent to *epistēmē*, 'scientific knowledge', in the following parenthesis.

³⁴¹ That is, I think, on each of the discontinuous parts just by itself.

³⁴² I.e. each segment's limits or boundaries are at the same pitch as the whole segment.

³⁴³ On 'excesses', *hyperochai*, see n. 62 above. As the intervals become smaller, the terms of their ratios become larger, and the *hyperochē* of the greater term over the smaller becomes a smaller fraction of the term that is exceeded. Thus in the ratio 2:1 (the octave) the *hyperochē* is equal to the smaller term, in the ratio 3:2 (the perfect fifth) it is half the smaller term, in 4:3 (the perfect fourth) it is one third of it, in 5:4 (the major third) it is a quarter, and so on. Hence the diminishing series of *hyperochai* gives a 'ranking order' (*taxis*) of intervals from the complete fusion of notes in the perfect concord or 'homophone' of the octave down through lesser degrees of concordance to progressively more obtrusive degrees of discordance. See further Ptol. *Harm.* I.7, especially 16.12–21, with Porph. 117.27–118.15.

- σιοι καὶ οἱ ἐπιμόριοι καὶ οἱ ἐπιμερεῖς, οἷς δὴ λόγοις αἱ διαφοραὶ τῶν ἀνισοτόνων διωρισμένων ψόφων παραμετροῦνται, περὶ ὧν ἐν τοῖς περὶ
- (30) τῶν συμφώνων ἐπὶ πλεον ποιησόμεθα λόγον. ἐκβεβλημένων οὖν τῶν ἀνισοτόνων συνεχῶν ψόφων τῆς ἁρμονικῆς θεωρίας, παραδεδεγμένων δὲ τῶν ἀνισοτόνων διωρισμένων, ἐν οἷς ἦσαν καὶ οἱ ἰσοτόνοι, ἐν τούτοις φησὶ τοὺς φθόγγους θεωρεῖσθαι λέγων·
- (86) **καὶ δὴ φθόγγους ἤδη καλοῖμεν ἂν τοὺς τοιούτους, ὅτι φθόγγος ἐστὶ ψόφος ἕνα καὶ τὸν αὐτὸν ἐπέχων τόνον.**
- (2) Τοὺς δὴ τοῖς μὲν πέρασι τῶν ἰσοτόνων ὀριζομένους, παραμετρομέ-
νους δὲ ταῖς τάξεσι τῶν ὑπεροχῶν φθόγγους φησὶ κλητέον, εἴτ' ἀποδίδω-
σιν ὅρον τοῦ φθόγγου· φθόγγος γὰρ ἐστὶ ψόφος ἕνα καὶ τὸν αὐτὸν
- (5) ἐπέχων τόνον, τόνον μὲν λαμβάνων ἀντὶ τῆς τάσεως, καθάπερ ἤδη κέχρη-
ται, τοὺς δὲ φερομένους ὅρους τοῦ φθόγγου μεταλαβών. φέρονται γὰρ
αὐτοῦ ὅροι παρὰ μὲν τοῖς Πυθαγορείοις “φθόγγος ἐστὶ ψόφος
κατὰ μίαν τάσιν ἐκφερόμενος,” παρὰ δὲ τοῖς Ἀριστοξενείοις·
“φθόγγος ἐστὶ φωνῆς ἐμμελοῦς πτώσις ἐπὶ μίαν τάσιν,” ἢ “ἐμμελῆς
- (10) οὖν φωνῆς πτώσις ἐπὶ μίαν τάσιν.” φωνῆς μὲν ἐμμελοῦς εἴρηται,
ἐπεὶ περ οὐ περὶ πάσης φωνῆς ὁ λόγος, ἀλλὰ τινος, τουτέστι τῆς
ἐμμελοῦς, ἐμμελῆ δὲ φωνὴν τὴν αὐτὴν τῇ διαστηματικῇ τιθέμενος,
ὅθεν δυνάμει τὸ λεγόμενον μὲν ἐστὶ φωνῆς διαστηματικῆς. διαστηματικὴ
δὲ φωνὴ ἐστὶν ἢ πρὸς μέλος ἐπιτήδειος, ἣν διαστέλλονται πρὸς τὴν
- (15) κατὰ τὰς ὁμιλίας εἰς τὴν χρῆσιν παραλαμβανομένην, ἣν “συνεχῇ τε καὶ
λογικῇ” καλεῖν εἴωθεν ὁ Ἀριστόξενος, πτώσιν δὲ διὰ τὴν μὲν
συνεχῇ ὥσανεἰ ἐστῶσαν εἶναι· τὴν μέντοι διαστηματικὴν τὴν ὀρθότητα
μὴ σῶζουσαν κεκλᾶσθαι καὶ μονονουχὶ ἀπὸ τοῦ ἐστάναι πεσοῦσαν
ἐμμελῆ γεγονέναι· διὸ καὶ τὸ μέλος ἀποδιδόσιν κλάσιν φωνῆς. ὥσπερ
- (20) γὰρ καὶ ἐπὶ τῶν ξύλων, οἷον ξύλων ἢ δένδρων, τὰ μὲν ἰθυτενῇ ὀρθά

29 διαμετροῦνται g

2 ἰσοτονῶν Ptol. 4 ὅρος φθόγγου in marg. m. pr. rubro T 5 τάσεως] τάξεως M κέχρηται
g 8 κατὰ] παρὰ g 10 οὖν om. g 16 πτώσις g

and the epimeric; and by these ratios the differences in unequal-toned discontinuous sounds are measured. We shall discuss them | more fully in our treatment of the concords.³⁴⁴ Now that the unequal-toned continuous sounds have been expelled from harmonic theory, and the unequal-toned discontinuous sounds (in which equal-toned sounds are also included) have been accepted, he says that it is among them that the notes are to be found. This is what he says.

And indeed we could now call sounds of this sort ‘notes’, since a note is a sound that maintains one and the same tone (*tonos*). Ptol. *Harm.* 10.18–19 [86D]

He says that those <sounds> that are bounded by the limits of what is equal-toned, and are measured against one another by the ranking orders of their excesses, should be called ‘notes’; and he then provides a definition of the note. The note, he says, is a sound that maintains one and the same | tone (using ‘tone’ instead of ‘pitch’, as he had done before), modifying definitions of the note that are in common currency. Definitions of it are current among the Pythagoreans – ‘a note is a sound given out at a single pitch’³⁴⁵ – and among the Aristoxenians – ‘a note is the falling of melodic voice on a single pitch’, or ‘the melodic | falling of the voice on a single pitch’.³⁴⁶ ‘Of melodic voice’ is said because the account is not concerned with all voice but only one sort, that is, the melodic,³⁴⁷ treating melodic voice as the same as intervallic voice, so that what is said, by implication, is ‘of intervallic voice’. Intervallic voice is the kind suitable for melody, and they distinguish it from the kind | adopted for use in conversation, which Aristoxenus was in the habit of calling ‘continuous and appropriate to speech’.³⁴⁸ The definition refers to ‘falling’ because the continuous voice stands firm, as it were, while the intervallic does not preserve uprightness but is fragmented, and becomes melodic by falling, in effect, from a standing position. Hence people call melody ‘fragmentation of the voice’.³⁴⁹ For just as with | external objects such as beams or trees, those that are straight and remain upright are thought of as somehow

³⁴⁴ For this ‘treatment’ see I.5–7 and I.15 below.

³⁴⁵ A definition in precisely this form does not seem to be attested elsewhere.

³⁴⁶ I translate *prōsis* as ‘falling’ (rather than as ‘incidence’, which might be more natural English) in view of Porphyry’s manoeuvres below with the cognate verb *piptein*, to fall. The earliest formulation of the ‘Aristoxenian’ definition is at Aristox. *El. harm.* 15.15–16, but it does not include the term ‘melodic’. Porphyry’s versions appear in several Aristoxenian sources, the first at e.g. Bacchius *Harm.* 292.15–16 Jan, and the second at Cleonides *Harm.* 179.9–10 Jan.

³⁴⁷ Cf. Thrasyllus *apud*. Theo Smyrn. 48.6–8. I owe the reference to Massimo Raffa, who suggests that Porphyry was working with a copy of Thrasyllus’ treatise to hand.

³⁴⁸ Cf. *El. harm.* 9.21.

³⁴⁹ On this assertion and the passage in general see Section 5(c) of the Introduction.

- διαμένοντα συνεχῇ πῶς θεωρεῖται, τὰ δ' ὑπ' ἀνέμου ἢ τινος ἄλλης βίας παθόντα κλασθέντα πίπτει· οὕτω καὶ ἡ φωνὴ ἐν συνεχείᾳ μὲν διαμένουσα ὀρθή τις εἶναι καὶ ἄκλαστος νομίζεται, λυγισθεῖσα δὲ καὶ πεσοῦσα μελωδική γίνεται. τὸ δ' "ἐπὶ μίαν τάσιν", ἔπει τὸ μὲν ὅλον μέλος
- (25) πτώσις ἐστὶν ἐπὶ πολλὰς τάσεις καὶ τοσαύτας, ὅσας ἐν ἑαυτῷ περιέχει κατὰ τὸ σύστημα, ὃ δὲ φθόγγος ἐν τι μέρος ἐλάχιστον ὧν τοῦ μέλους ἐξ ἀνάγκης καὶ τὴν ἐφ' ἑαυτὸν γινομένην πτώσιν μίαν ἔχει. καὶ μὴν καὶ διὰ τὰς εἰρημένους τῶν ἀνισοτόνων συνεχῶν ψόφων παρατηρήσεις πρόσκειται τὸ "ἐπὶ μίαν τάσιν" διὰ τὸ ἔχειν καὶ ἀρχὴν καὶ μέσα καὶ
- (30) τέλος τὸν φθόγγον — ἔστι γὰρ διαστατός — δι' ὅλου <δὲ> δεῖν ὁμοιον εἶναι.
- (87) "Ὅπερ οὖν παρὰ τοῖς Ἀριστοξενείοις ἀπεδόθη τὸ "εἶναι τὸν φθόγγον φωνῆς ἐμμελοῦς πτώσιν κατὰ μίαν τάσιν ἐκφερομένην", τοῦτο μετεῖληπται εἰς τὸ "εἶναι τὸν φθόγγον ψόφον ἕνα καὶ τὸν αὐτὸν ἐπέχοντα τόνον", ἀντὶ μὲν "τῆς φωνῆς" τοῦ ψόφου παρειλημμένου ἀκριβέστερον διὰ τοῦς
- (5) τὴν φωνὴν ἐπὶ τῆς ὑπὸ ζῶων προΐεμένης καθ' ὁρμὴν διὰ τὰς ἀρτηρίας ἐνάρθρου ἡχῆς ὑπακούοντας, ἐπὶ δὲ τῶν ἀψύχων ὀργάνων μηκέτι προσι- μένους τοῦνομα, ἀντὶ δὲ τοῦ "ἐν μιᾷ τάσει" τοῦ "ἕνα καὶ τὸν αὐτὸν ἐπέχειν τόνον" εἰρημένου. ὁ γὰρ τόνος ἀντὶ τῆς τάσεως πολλάκις [εἴρη- ται] παρελήφθη. δόξει δὲ μὴ εἶναι ἀκριβὲς ὁ ὑπὸ τοῦ Πτολεμαίου ἀποδο- θείς ὁρος τῷ προσπεριλαμβάνειν καὶ τῆς συνεχοῦς φωνῆς καὶ τῶν ἀπλῶν καὶ μὴ μελωδομένων ψόφων τὰ μέρη. ἐγχωρεῖ γὰρ καὶ ἐπὶ τῆς ὀξείας ἢ βαρείας συλλαβῆς τάττειν τὸ "εἶναι ψόφον τὸν ἕνα καὶ τὸν αὐτὸν ἐπέ- χοντα τόνον." οὐκέτι καὶ τῶν ἄλλων ὅρων εἰς τὸ αὐτὸ ἔγκλημα ὑπαγο- μένων τῷ "φωνῆς ἐμμελοῦς" ἀποδεδόσθαι "πτώσιν ἐπὶ μίαν τάσιν" τὸν
- (15) φθόγγον. τὸ τε γὰρ "ἐμμελοῦς" προσκείμενον καὶ "τὴν πτώσιν" δια- στέλλει ἱκανῶς ἀπὸ τῶν μερῶν τῆς συνεχοῦς φωνῆς τὸν φθόγγον. εἰ μὴ ἄρα τις λέγοι, ὅτι φθόγγος παρειλημμένος ἱκανῶς μηνύει, περὶ τίνος ἐστὶν ὁ λόγος· εἰ γὰρ ἐμμελής λέγεται φθόγγος, τούτου ἂν εἴη καὶ ὁ ὅρος ἀποδεδομένος.

29 τὸ ἔχειν] τὰ ἔχοντα G 30 <δὲ> add. Theiler

2 φωνῆς — 3 φθόγγον om. T πτώσις M κατὰ] ἐπὶ Aristox. 4 ἀντὶ — 13 τόνον om. G 6—7 προσιεμένους Alexanderson προιεμένους codd. 8—9 [εἴρηται] del. Alexanderson 13 ὅρων om. G 14 ante φωνῆς add. τῆς g 15 προκείμενον p

continuous, while those affected by the wind or by some other force are broken and fall, so the voice that preserves its continuity is treated as upright and unbroken, but when it is thrown down³⁵⁰ and falls it becomes melodic. 'On a single pitch' is said because melody as a whole | is a falling on many pitches, as many of those in the scale as it includes in itself, whereas since a note is a single, minimal part of the melody, there is necessarily also a single falling associated with it. And it is also because of the observations, already discussed, about unequal-toned continuous sounds that 'on a single pitch' is added, since a note has a beginning and middle parts and | an end – for it is divisible – and must be the same throughout.

Thus the Aristoxenians' assertion that a note is 'a falling of melodic voice, given out³⁵¹ on a single pitch' has been modified <by Ptolemy> into the statement that a note is 'a sound that maintains one and the same tone'. He substitutes 'sound' for 'voice', and this is more accurate, on account of the people | who understand 'voice' as applying to the articulated sounds (*ēchē*) emitted by living creatures through the windpipe as the result of an impulse, and who do not allow the noun 'voice' in connection with inanimate instruments; and he substitutes 'maintaining one and the same tone' for 'on a single pitch', since 'tone' (*tonos*) has often been used in place of 'pitch'. But the definition that Ptolemy gives seems not to be accurate, | in that it also embraces the parts of continuous voice and of simple sounds that are not sung. For it is possible to say of a high or a low-pitched <spoken> syllable that it is 'a sound maintaining one and the same tone'.³⁵² The other definitions are not liable to the same accusation, since they assert that the 'falling on a single pitch' which is a note is that 'of melodic voice'. | For the addition of 'melodic' and 'a falling' distinguishes the note adequately from the parts of continuous voice. <The criticism of Ptolemy stands> unless one were to say that the mention of a note is a sufficient indication of what the account is about; for if 'a note' implies 'melodic', it will be of this that the definition is given.³⁵³

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³⁵⁰ The usual sense of *lugizein* is 'to twist', but it means 'to throw down' (in a wrestling match) at Theocritus 1.97–8, and that sense is clearly more appropriate to the present context.

³⁵¹ 'Given out' (*ekpheromenēn*) is not in the Aristoxenian definitions previously quoted; it has apparently been transferred, accidentally or otherwise, from the one attributed to the Pythagoreans.

³⁵² Cf. 84.16–28 above, and see Introduction pp. 42–3.

³⁵³ This is obviously inadequate as a defence of Ptolemy. If being a note essentially involves being melodic, and if this fact absolves one from mentioning its melodic character in the definition, then the same should be true of all a note's other essential features, which is absurd. It is hard to suppose that Porphyry intended his suggestion seriously. Can it be a rare example of Porphyrian irony?

διὸ καὶ μόνος μὲν

ἕκαστος ἄλογος, εἷς γὰρ καὶ πρὸς ἑαυτὸν ἀδιάφορος, ὁ δὲ λόγος τῶν [20]
πρὸς τι καὶ ἐν δυσι τοῖς πρώτοις. κατὰ δὲ τὴν πρὸς ἀλλήλους, ὅταν
ὥσιν ἀνισότονοι, παραβολὴν ποιῇ τινα λόγον ἐκ τοῦ ποσοῦ τῆς ὑπεροχῆς,
ἐν οἷς δὴ τό τε ἐκμελὲς ἤδη καταφαίνεται καὶ τὸ ἐμμελές.

- (21) Ἐπειδὴ διὰ τοῦ ποσοῦ ὁ ὅρος τοῦ φθόγγου ἀποδίδεται—ψόφος γὰρ
ἐστὶν ἓνα καὶ τὸν αὐτὸν ἐπέχων τόνον, ὃ σημαίνει ὅτι καθ' ἑαυτὸν ἀδιά-
φορος ὁ φθόγγος—εἷη γὰρ καὶ μεριστὸς καθ' ὅσον αἰσθητὸς καὶ οὐκ
ἀδιάστατος, ἀλλ' ὁμοιομερὲς καὶ ταύτῃ ἐοικὼς ἀριθμῷ ἐξ ὁμοίων μονά-
(25) δων συνεστῶτι. ἐπεὶ τοίνυν αὐτὸς τε εἷς καὶ πρὸς ἑαυτὸν ἀδιάφορος,
ἀποδέδοται δὲ δι' ἀριθμοῦ, εἷη ἂν καθ' ἑαυτὸν ἄσχετος, εἰ δ' ἄσχετος,
καὶ ἄλογος· ἄλογος δὲ κατὰ τὸ σημαίνόμενον τοῦ λόγου, ὃ παρίστησιν
δύο μεγεθῶν ὁμογενῶν τὴν κατὰ πηλικότητα ποιὰν σχέσιν εἶναι τὸν
λόγον. ὥστ' εἴπερ ἐν ποσότητι ὁ φθόγγος, ἄσχετῳ δὲ καθ' ἑαυτὸν, εἷη
(88) ἂν ἄλογος κατὰ τὸ εἰρημένον σημαίνόμενον τοῦ λόγου ὁ φθόγγος. δεῖ
δὲ γινώσκειν, ὅτι καὶ ποιότητες ὥσιν αἱ διαφοραὶ τῶν ψόφων αἱ κατ'
ὀξύτητα καὶ βαρύτητα, οὐδὲν κωλύει ὥς περὶ ποσὸν ποιεῖσθαι τὸν λόγον
τῶν φθόγγων ὥς τῇ ποσότητι τοῦ ὑποκειμένου ἐπιγίνεσθαι ταύτας τὰς
(5) διαφοράς, ἥ ὥσπερ ὁ Παναίτιος ἔφασκε, “μέτρα τινὰ τοὺς παλαιοὺς
κατ' ἀναλογίαν τοῖς φθόγγοις παραβάλλειν ἀπὸ τῶν ἀριθμῶν, οἷς χρωμέ-
νους ἡμᾶς τὸ παχὺ καὶ ἀβέβαιον τῆς ἀκοῆς ἐκκλίνειν.” αὐτὸς μὲν οὖν καθ'
ἑαυτὸν ὁ φθόγγος ἄλογος· ὅταν δ' ὥσι δύο φθόγγοι, ἥτοι ἰσότονοί εἰσιν

21 ποσοῦ] ψόφου conl. Wallis

24 ἀδιάστατος] ἀδύνατος p

26 εἰ δὲ ἄσχετος om. Mg

28 ποιὰν Theiler ὁμοίαν codd.

1 ἂν ἀνάλογος p

| Hence each taken alone is *alogos*,³⁵⁴ for it is one and undifferentiated in relation to itself, whereas a ratio is a relation and occurs first in two terms. But when notes that are unequal-toned are placed in a comparative relation with one another, it makes a ratio from the quantity of the excess of the one over the other, and it is in these that the melodic and the unmelodic appear. Ptol. *Harm.* 10.19–23

Since the definition of the note is given in terms of quantity – for it is a sound maintaining one and the same tone, which indicates that in itself a note is undifferentiated – it must also be divisible and not indivisible in so far as it is perceptible, but homoeomerous and in this respect similar to a number that is composed | of identical units.³⁵⁵ Since, then, it is one and undifferentiated in relation to itself, and is expressed through a number, it must in itself be non-relational (*aschetos*), and if it is non-relational it must also be *alogos* – *alogos* in the sense corresponding to what is meant by *logos* when a *logos* is the specific relation in size that holds between two magnitudes of the same kind.³⁵⁶ Thus if indeed a note consists in a quantity, one that is non-relational in itself, the note must be *alogos* according to the sense of *logos* that has been specified.

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But one must realise that even if the differences between sounds in respect of height and depth are qualities, there is nothing to prevent us from giving an account of notes in terms of quantity, on the grounds that these differences arise from the quantity of what | underlies them; or, as Panaetius puts it, ‘the ancient writers applied proportional measures to the notes on the basis of numbers, which we use to exclude the imprecision and instability of hearing’.³⁵⁷ In itself, then, a note has no ratio; but when

³⁵⁴ That is, it has no ratio (*logos*), as Porphyry explains below. The adjective *alogos* is more frequently used to refer to something which ‘lacks a ratio’ for a different reason, specifically to a relation between quantities which cannot be expressed as a ratio between whole numbers (as e.g. the relation between the side and diagonal of a square). In those cases *alogos* can be translated as ‘irrational’; but the word would be inappropriate here.

³⁵⁵ The individual assertions in this sentence present no serious difficulties, but the relations between the clauses are a little obscure. The parenthesis does not seem to give an explanation for what is said in the preceding clause, as its introductory ‘for’ suggests; and at the beginning of the clause immediately after the parenthesis my translation omits another ‘for’, which is hard to work into the syntax. Perhaps the parenthesis extends to the end of this group of clauses (in which case the second ‘for’ could perhaps be justified), and the ‘since’ at the start of the next sentence recapitulates the ‘since’ with which the passage begins. But this proposal, too, does not seem altogether satisfactory.

³⁵⁶ Cf. 90.24–91.1. The definition is taken from Euclid *El.* V, definition 3. Cf. n. 211 above.

³⁵⁷ This sentence does not appear in the passage quoted from Panaetius at 65.24–67.10 above (though it chimes well with 66.7–12); nor is it clear how it supports the point that Porphyry has just made. Perhaps he means that even though Panaetius shares his view that pitch-differences are qualitative (as the passage quoted earlier shows), he nevertheless recognises the usefulness of representing them in terms of numbers. Panaetius’ way of giving the mathematical approach legitimacy is the same as Porphyry’s: ‘Thus when they say that the octave is in double ratio, they do not mean that the one note is double the other, but that the strings which produce the notes that form the octave are in this ratio, and so on for the others’ (66.30–67.3).

- ἢ ἀνισότονοι. ἰσοτόνους δ' ἀκουστέον νῦν οὐχ ὡς τὸν ἕνα καὶ τὸν αὐτόν, ὅταν ὁμοιομερὴς ᾖ, λέγομεν ἰσότονον, ἀλλὰ κατὰ τὸ ἕτερον σημαίνον-
 (10) μενον τοῦ ἰσοτόνου, ὃ ἐπὶ δυοῖν ἐτάττετο ἴσην ἐχόντων τάσιν. οἱ μὲν οὖν ἰσότονοι ἀπαράλλακτοι ὄντες κατὰ τὴν τάσιν ἐνὶ ἐοίκασιν ἰσοτόνω· διὸ οὐδὲ περιέχουσι διάστημα. εἰ δὲ χρή καὶ τούτους ἀλόγους καλεῖν
 (15) ἢ λόγον μὲν ἔχειν, διάστημα δ' οὐ, ἐξῆς διορισθήσεται ἐν τῷ περὶ συμφωνιῶν λόγῳ· ἔνθα καὶ περὶ λόγων ἀκριβέστερον καὶ περὶ διαστημάτων διαλεξόμεθα. οἱ μὲν οὖν ἰσότονοι τὰ νῦν παρεκκείσθωσαν.

- Οἱ δ' ἀνισότονοι φθόγγοι, φησί, κατὰ τὴν πρὸς ἀλλήλους παραβολὴν ποιοῦσιν τινὰ λόγον ἐκ τοῦ ποσοῦ τῆς ὑπεροχῆς· λόγοι μὲν γὰρ εἰσιν οἱ τε διπλάσιοι καὶ οἱ τριπλάσιοι καὶ πάντες, ὅσοι πολλαπλάσιοι, οἱ τε
 (20) ἡμίολιοι καὶ ἐπίτριτοι καὶ ὅλως ἐπιμόριοι καὶ οἱ τοιοῦτοι· τὸ τε διάφορον εἰλήφασιν ἐκ τῆς διαφόρου ὑπεροχῆς θατέρου ὅρου τοῦ λοιποῦ. φέρε γὰρ ἔστω ὁ ὑπερέχων ὅρος ὁ ιβ'. οὗτος δις μὲν τινὰ ἔχων καὶ ἴσῳ τοῦ ὑπερεχομένου ὑπερέχων ἐν λόγῳ γίνεται τῷ διπλασίῳ, οἷον ὁ ιβ' πρὸς τὸν 5'. ὑπερέχων δὲ τῷ ἡμίσει τοῦ ὑπερεχομένου οἷον τοῦ ἡ
 (25) ἐν λόγῳ θεωρεῖται τῷ ἡμιολίῳ· τῷ δὲ τρίτῳ ὑπερέχων τοῦ ὑπερεχομένου οἷον τοῦ θ' ἐν λόγῳ θεωρεῖται τῷ ἐπιτρίτῳ· ὥστ' ἐκ τοῦ ποσοῦ τῆς ὑπεροχῆς ἢ διαφορὰ τῶν λόγων ὑφίσταται.

- Παραβολὴν δὲ λέγουσιν οἱ περὶ τὰ μαθήματα τὴν πρὸς ἀλλήλας σχέ-
 (30) σιν τῶν ὁμοιογενῶν. ἐν οὖν τοῖς πρὸς ἀλλήλους παραβαλλομένοις φθόγοις καὶ σχέσιν τινὰ πρὸς ἀλλήλους κεκτημένοις καὶ λόγον τὸ ἐμμελὲς ἤδη καταφαίνεται καὶ τὸ ἐκμελές. τὸ γὰρ ἐκμελές ἢ ἐμμελές οὐκ ἄσχετον, ἀλλ' ἐν τῇ πρὸς ἕτερον φθόγγον φθόγγου σχέσει θεωρεῖται. τὸ μὲν
 (89) οὖν ἐκμελές, ὅτι ἄλλοτριότητα καὶ τὸ ἀναπτον καὶ ἀσυνάρμοστον σημαίνει, πρόδηλον, τίνες δ' οἱ ἐκμελεῖς, ρηθήσεται ὕστερον. τὸ δ' ἐμμελές, ὅτι σύναψιν καὶ συνάρμοσιν σημαίνει βούλεται, καὶ τοῦτο γινώριμον.

16 παρεκκείσθω g 20 ante ἐπίτριτοι add. οἱ p 22 δις] διὰ g 24 τοῦ^{sec.} Alexanderson τῷ codd. 24 οἷον — 25 ὑπερεχομένου om. g 26 τοῦ^{prim.} Alexanderson τῷ codd. 32 φθόγγου om. T

1 τό om. g

there are two notes, they are either equal-toned or unequal-toned. We must now understand 'equal-toned' not in the sense in which we call one and the same note 'equal-toned' when it is homoeomerous, but in the other sense | of 'equal-toned', which is applied to two notes that have equal pitch. Now since equal-toned notes are not different in pitch they are like a single equal-toned note, and hence do not surround an interval. Whether these too should be called *alогоi*, or should be said to have a ratio but not an interval, will be investigated later in our | discussion of concords, where we shall also speak more precisely about ratios and intervals.³⁵⁸ For the present let us leave equal-toned notes on one side.

Unequal-toned notes, says Ptolemy, when placed in a comparative relation³⁵⁹ with one another, make a ratio from the quantity of the excess.³⁶⁰ Ratios include the doubles and the triples and all the multiples, and the | hemiolics and the epitritics and the epimorics in general, and others of that sort. The difference between them arises from the differing excess of the one term over the other. For instance, let the greater term be 12. When this contains twice some other and exceeds the smaller by an amount equal to that which is exceeded, it is in double ratio, as 12 is to 6. When it exceeds the smaller by half of that which is exceeded, as it does 8, | it is in hemiolic ratio. And when it exceeds the smaller by a third of that which is exceeded, as it does 9, it is in epitritic ratio. Thus the difference between the ratios arises from the quantity of the excess.

'Comparative relation' (*parabolē*) is the name given by experts in the mathematical disciplines to the relation holding between things of the same kind. It is thus in notes that are compared with one another | and have a relation and a ratio to one another that the melodic and the unmelodic appear. For the melodic or unmelodic is not non-relational, but is found in the relation of one note to another. It is obvious that the unmelodic indicates inappropriateness and disconnection and lack of mutual attunement; and we shall explain later which the unmelodic notes are. It is also easily recognised that the melodic signifies connection and mutual attunement.

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³⁵⁸ See 90.24–95.19 below.

³⁵⁹ 'Comparative relation' is a cumbersome attempt to give the sense of the noun *parabolē*. Elsewhere it usually means 'comparison'; here, however, it does not refer to the mental operation of comparing, but to the relation between two items which can be quantitatively compared. See the opening of the next paragraph.

³⁶⁰ That is, the excess (*hyperochē*, cf. n. 62 above) of the one note, i.e. one term of the ratio, over the other. The reference to 'quantity' may suggest that it is treated here as a simple amount or a number, but it is not; it must be interpreted in line with Porphyry's and Ptolemy's normal usage, as the fraction of the smaller term by which the larger exceeds it.

- (5) τίνα δ' ἔχει διαφορὰν τὸ ἐμμελὲς πρὸς τὸ σύμφωνον, ὅταν τίνες οἱ ἐμμελεῖς, καὶ τίνες οἱ σύμφωνοι φθόγγοι φανεροὶ γένωνται, ἔσται σαφές. διακρίνειν γὰρ βούλεται τούτους ὁ Πτολεμαῖος καὶ μὴ πάντως τοὺς ἐμμελεῖς εἶναι καὶ συμφώνους, εἰ καὶ πάντως οἱ σύμφωνοι καὶ ἐμμελεῖς συντόμως δὲ καὶ αὐτὸς τὰ νῦν ἐκδιδάσκει περὶ τούτων ἐπάγων.

εἰσὶ δὲ

ἐμμελεῖς μὲν ὅσοι συναπτόμενοι πρὸς ἀλλήλους εὐφοροὶ τυγχάνουσι πρὸς ἀκοήν, ἐκμελεῖς δὲ ὅσοι μὴ οὕτως ἔχουσι. συμφώνους δὲ ἔτι φασὶν [25] εἶναι παρὰ τὸν κάλλιστον ἤδη τῶν ψόφων, τὴν φωνήν, ὀνοματοποιούντες, ὅσοι τὴν ὁμοίαν ἀντίληψιν ἐμποιοῦσι ταῖς ἀκοαῖς, καὶ διαφώνους τοὺς μὴ οὕτως ἔχοντας.

- (10) Προελθὼν ἀκριβέστερον περὶ τούτων διαλήψεται προστιθεὶς τοῖς ἐμμελεῖσι καὶ συμφώνοις καὶ ὁμοφώνους· νῦν δὲ διὰ τὴν φερομένην διάταξιν ἐμμελεῖς μὲν ἀποδέδωκε τοὺς εὐφόρους ἀλλήλοις συναπτομένους, συμφώνους δὲ τοὺς τὴν ὁμοίαν ἀντίληψιν ἐμποιούντας ταῖς ἀκοαῖς. ἔστι δ' ἡ διαφορὰ, ὅτι οἱ μὲν οὐκ ἐναντιοῦνται μόνον πρὸς τὴν ἀλλήλων συναφήν, οἱ δὲ καὶ <οὐκ> ἐναντιοῦνται καὶ ὁμοίως ταῖς ἀκοαῖς προσπίπτουσιν.
- (15) “ἔστι γὰρ συμφωνία дуεῖν φθόγγων ὀξύτητι καὶ βαρύτητι διαφερόντων κατὰ τὸ αὐτὸ πτώσις καὶ κῆσις. δεῖ γὰρ τοὺς φθόγγους συγκρουσθέντας εἶναι τι εἶδος ἀποτελεῖν φθόγγου” τῇ ἀκοῇ, οὔτε τῆς ὀξύτητος ὑπερβαλλούσης καὶ αὐτὴν παρεμφαινούσης, οὔτε τῆς βαρύτητος, ἀλλ' οἷον εἰ κράσεως τοιαύτης γενομένης ὡς τῶν κεκραμένων μὴ ἐπικρατεῖν θατέρου θάτερον, μηδὲ τὴν αὐτοῦ δύναμιν ἐμφαίνειν ἢ ὑπερβάλλουσιν τῆς θατέρου ἢ ἐλλείπουσαν. ἐὰν γὰρ ἡ ἀκοὴ τοῦ βαρέος μᾶλλον ἐν τῇ συγκρούσει ποιῇται τὴν ἀντίληψιν ἢ πάλιν τοῦ ὀξέος, ἀσύμφωνόν ἐστι τὸ τοιοῦτον. τοὺς οὖν τοιούτους φθόγγους κεκλήκασι συμφώνους παρὰ τὸν κάλλιστον φησὶν ἤδη τῶν ψόφων τὴν φωνὴν ὀνοματοποιήσαντες. τῷ μὲν γὰρ γένει ψόφος καὶ ἡ φωνή, ἐπεὶ δὲ τῶν αἰσθητῶν τὸ ζῶον τοῦ μὴ ζῶου κρεῖττον καὶ τὸν ὑπὸ ζῶου ἢ ζῶων προϊέμενον ψόφον, ὅπερ ἐστὶν ἡ φωνή, κρεῖττονα τῶν μὴ οὕτως ἀποτελουμένων ἐτίθεντο ψόφον. καὶ

6 τούτους] τούτων p 11 καὶ ὁμοφώνους om. G 14 οὐκ del. Alexanderson 15 <οὐκ> addidi 17 γὰρ om. T ἐγκρουσθέντας T 20 ὡς τῶν] αὐτῶν g 26 ἐπεὶ] ἐπὶ m 27 ζῶον m 28 ψόφον] ψόφων Alexanderson

What the difference is between the melodic and the concordant will be obvious when it becomes clear which are the melodic notes | and which are the concordant notes. For Ptolemy wants to distinguish them, and to say that melodic notes are not always concordant, even though concordant notes are always melodic. For the present he gives a brief explanation of these matters, as follows.

Melodic notes are those which are agreeable to the hearing when joined together³⁶¹ with one another, and unmelodic notes are those which are not. Again, people give the name 'concordant' (*sympḥōnos*), which they take from the most beautiful of sounds, the voice (*phōnē*), to those which make a homogeneous impression on the hearing, and 'discordant' (*diaphōnos*) to those which do not. Ptol. *Harm.* 10.23–8

| Ptolemy will later discuss these things more precisely, adding the homophones, too, to the melodic and concordant notes. Now, however, drawing on a distinction in common use, he states that notes which are agreeable when joined together with one another are melodic, while those that make a homogeneous impression on the hearing are concordant. The difference is that the former merely do not resist being joined together with one another, | whereas the latter not only do not resist, but also fall homogeneously on the hearing. 'For concordance is the coincidence and blending of two notes that differ in height and depth. For when the notes are played at the same time, they must produce one note of some sort'³⁶² to the hearing, in which neither the height nor the depth of pitch dominates and reveals itself, but which is like | the kind of blend in which neither of the things blended overcomes the other, nor does its character appear as either dominating or falling short of the other's. For if the hearing grasps to a greater extent the lower element in what is played at the same time, or again the higher, this sort of thing is non-concordant. People call notes of this kind 'concordant', he says, taking the name from | the most beautiful of sounds, the voice. For voice too, in its genus, is sound, but since among perceptible things the living creature is superior to the inanimate, they reckoned that the sound emitted by a living creature or creatures, that is, the voice, is also a superior sound to those which are not produced in this

³⁶¹ That is, joined together in sequence, not simultaneously. The 'homogeneity' of a concord, by contrast, is regularly conceived as displaying itself when the two notes are played at the same time.

³⁶² Quoted, with minor omissions and alterations, from Aelianus at 35.26–8 above; see n. 135 ad loc. Similar definitions or descriptions are given by many writers; for a lucid formulation see Nicomachus *Harm.* 262.1–5 Jan.

γάρ πως καὶ οἱ δοκοῦντες εἶναι ἀπὸ τῶν μουσικῶν ὀργάνων καλοί, τὴν

- (90) φωνὴν ἢ μιμεῖσθαι σπουδάζουσι, καὶ ὅμως τοῦ κατ' αὐτὴν διηρθρωμένου οὐ κατὰ πᾶν τυγχάνειν δύνανται.

Ἐμβὰς τοίνυν εἰς τὸν περὶ τῶν συμφώνων λόγον τὰς τῶν Πυθαγορείων περὶ αὐτῶν διατάξεις δοκιμάζει πρότερον, εἴθ' οὕτω τὰ

- (5) αὐτῷ ἀρέσκοντα τίθησιν, ὧν ἀπ' ἄλλης ἀρχῆς τὴν ἐξήγησιν ποιησόμεθα.

ε'

- (7) Χρὴ γινώσκειν, ὅτι τῆς ἀρμονικῆς “πάντες οἱ φθόγγοι γίνονται πληγῆς τιнос γενομένης” πληγὴν δ' ἀμήχανον γίνεσθαι μὴ οὐχὶ κινήσεως πρότερον γινομένης. τῶν δὲ κινήσεων αἱ μὲν εἰσι πυκνότεραι, αἱ δ' ἀραιότεραι, καὶ αἱ μὲν πυκνότεραι ὀξυτέρους ποιοῦσι τοὺς φθόγγους, αἱ δ' ἀραιότεραι βαρυτέρους. ἀναγκαῖον οὖν ἔστι τοὺς μὲν ὀξυτέρους εἶναι, ἐπεὶ περ ἐκ πυκνότερων καὶ πλειόνων σύγκεινται κινήσεων, <τοὺς δὲ βαρυτέρους, ἐπεὶ περ ἐξ ἀραιοτέρων καὶ ἑλασσόνων σύγκεινται κινήσεων>, ὥστε τοὺς μὲν ὀξυτέρους τοῦ δέοντος <ἀνιεμένους ἀφαιρέσει κινήσεως
- (15) τυγχάνειν τοῦ δέοντος, τοὺς δὲ βαρυτέρους> ἐπιτεينوμένους προσθέσει κινήσεων τυγχάνειν τοῦ δέοντος. διόπερ ἐκ μορίων συγκεῖσθαι τοὺς φθόγγους φατέον, ἐπειδὴ προσθέσει καὶ ἀφαιρέσει τυγχάνουσι τοῦ δέοντος. πάντα δὲ τὰ ἐκ μορίων συγκεῖμενα <ἀριθμοῦ λόγῳ λέγεται πρὸς ἄλληλα, ὥστε καὶ τοὺς φθόγγους ἀναγκαῖον ἐν> ἀριθμοῦ λόγῳ λέγεσθαι
- (20) πρὸς ἄλλήλους. τῶν δ' ἀριθμῶν οἱ μὲν ἐν πολλαπλασίονι λόγῳ λέγονται, οἱ δ' ἐν ἐπιμορίῳ, οἱ δ' ἐν ἐπιμερεῖ, καθ' ἃ προεῖρηται, ὥστε καὶ τοὺς φθόγγους ἀναγκαῖον ἐν τοῖς τοιοῦτοις <λόγοις> λέγεσθαι πρὸς

29 καλοί] κλητὴν Wallis et Düring

1 ἦ] εἰ vel [ἦ] Alexanderson 2 συντυγχάνειν G 5 τέλος τοῦ τετάρτου κεφαλαίου add. p 6 ἔτι τοῦ αὐτοῦ ἐξήγησις εἰς τὸ πέμπτον κεφάλαιον· συμφωνίας δ' ἡ μὲν αἴσθησις καταλαμβάνει add. p 8 γινομένης Eucl. γενέσθαι Eucl. 9 γενομένης Eucl. πυκνότεραί εἰσιν Eucl. 11 οὖν ἔστι om. Eucl. 12 <τοὺς – 13 κινήσεων> Eucl. 14 <ἀνιεμένους – 15 βαρυτέρους> Eucl. 16 τοὺς φθόγγους συγκεῖσθαι Eucl. 17 προσθέσει] προσθέων g 18 <ἀριθμοῦ – 19 ἐν> Eucl. 20 πολλαπλασίῳ Eucl. διπλασίονι g 21 καθ' ἃ προεῖρηται non habet Eucl. 22 <λόγοις> Eucl.

way. And indeed the sounds which emerge from musical instruments and seem to be beautiful, in so far as they are striving to imitate the voice, are nevertheless unable to match in every respect that which the voice articulates.³⁶³ [90D]

Now that he has embarked on the discussion of the concords, he first assesses the propositions of the Pythagoreans about them, and then | sets down his own opinions, of which we shall provide an exposition from a different starting-point.³⁶⁴

Chapter 5

One must realise that in harmonics,

all notes occur when some impact occurs; and it is impossible for an impact to occur unless a movement occurs beforehand.³⁶⁵ Some movements are more closely packed, others more widely spaced, | and those which are more closely packed produce higher notes, while those which are more widely spaced produce lower ones. It is therefore necessary that some notes are higher, since they arise from more closely packed and more numerous movements, {and others are lower, since they are composed of more widely spaced and less numerous movements}. Hence those that are higher than is required {are slackened by the subtraction of movement | and so reach what is required, while those that are too low} are tightened by the addition of movement, and so reach what is required. We must therefore say that notes are composed of parts, since they attain what is required through addition and subtraction. All things that are composed of parts {are spoken of in a ratio of number with respect to one another, so that the notes, too, must} be spoken of in a ratio of number | to one another. Some numbers are spoken of in multiple ratio with respect to one another, some in epimoric ratio and some in epimeric, as was said above,³⁶⁶ so that notes must also be spoken of in {ratios} of these kinds to one another.

³⁶³ For the use of adverbial ἤ to mean 'in so far as' see LSJ s.v. ἤ II.3.

³⁶⁴ What Porphyry means by 'from a different starting-point (*archē*)' is not clear. The sense might be 'on the basis of a different principle', but perhaps he means no more than 'in a different chapter'.

³⁶⁵ The passage quoted here comes from the introduction to the Euclidean *Sect. can.* (148.3–149.24 Jan, omitting the first three and a half lines and the last ten). The version in the MSS of Porphyry differs from the MSS text of the *Sectio* in certain minor details which do not affect the sense, and which I have not indicated here. But it also omits a number of words and phrases which are more significant. I have included these words and phrases in the translation, but have enclosed them in brackets of this form, {}. For recent discussions of the passage see Barker (2007): 370–8, Creese (2010): 164–71.

³⁶⁶ 'As was said above' is not in the MSS of the *Sectio*, and is probably an addition by Porphyry, referring back to 85.26–30.

ἀλλήλους.”

“Λόγος δὲ λέγεται δύο μεγεθῶν ὁμογενῶν ἢ κατὰ πηλικότητα ποιά

- (91) σχέσις,” κατὰ δὲ τοὺς Ἀριστοξενεῖους “τὸ περιεχόμενον ὑπὸ δύο φθόγγων ἀνομοίων τῇ τάσει”· καὶ ἄλλοι ἄλλως ἐδόξασαν περὶ τοῦ διαστήματος.

Ἐρατοσθένης μὲν οὖν φησιν ἕτερον εἶναι διάστημα λόγου· ἐν

- (5) γὰρ ἐνὶ διαστήματι δύο λόγοι γίνονται. ὁ δὲ λόγος δις φέρεται, ὃ τε τοῦ μείζονος πρὸς τὸ ἔλαττον καὶ τοῦ ἐλάττονος πρὸς τὸ μείζον καὶ κοινὴ διαφορὰ ὑπεροχῆς καὶ ἐλλείψεως ὡς τῆς διαφορᾶς δηλονότι τὸ διάστημα ποιούσης. διπλασίου τε γὰρ φησι πρὸς ἡμισυ καὶ ἡμίσεος πρὸς διπλάσιον ὁ μὲν λόγος ἕτερος, τὸ αὐτὸ δὲ διάστημα. ἐκ δὲ τοιούτων οὔτε τί
- (10) καλεῖται διάστημα, οὔτε καθ’ ὃ διαφέρει τοῦ λόγου παρέστησεν.

‘The relation in size between two magnitudes of the same kind is called a ratio (*logos*)’;³⁶⁷ but according to the Aristoxenians, ‘that which is surrounded by two notes that are unlike in pitch’;³⁶⁸ and others have held other opinions about the interval (*diastēma*).³⁶⁹

Eratosthenes says that interval is different from ratio, for in | one interval there are two ratios; ratio is represented in two ways, as that of the greater to the smaller and as that of the smaller to the greater; but they share the same excess and deficiency – evidently implying that it is the difference that makes the interval.³⁷⁰ For he says that the ratios of double to half and of half to double are different, but that the interval is the same. But by such remarks he has not established what | is called an interval, nor in what respect it differs from a ratio.³⁷¹

³⁶⁷ Eucl. *El.* V definition 3.

³⁶⁸ A close paraphrase of Aristox. *El. harm.* 15.24–5; the exact wording is closer to Cleonides *Harm.* 179.11–12, though not quite identical. Porphyry does not point out that while the Euclidean statement is a definition of ratio (*logos*), that of Aristoxenus and his followers defines interval (*diastēma*); but the relation between the two conceptions is the main topic of the discussion that follows.

³⁶⁹ In the complicated passage from here to 95.22 Porphyry represents himself as trying to unravel the various views that previous writers had held about the nature of a *diastēma* (‘interval’), and the ways in which they had used the word. He reviews, in particular, the ways in which some of them had identified a *diastēma* with a *hyperochē* (‘excess’) a *diaphora* (‘difference’) or a *logos* (‘ratio’), especially the last of these, or had denied the validity of such identifications. The passage presents a number of difficulties, some of which are due to Porphyry’s insistence on explicating these conceptions of *diastēma* principally by reference to the other three terms I have listed, although they themselves, as used by the earlier theorists and by Porphyry himself in these discussions, do not always carry the same senses. The uses of *hyperochē*, in particular, are inconsistent and confusing. The problems are exacerbated by the fact that the differences to which Porphyry draws attention seem sometimes to be mere differences in terminology (as with the frequent use of *diastēma* in place of *logos*), and sometimes substantial differences in conception (as most obviously between the Aristoxenian and mathematical conceptions of a *diastēma*). Though sometimes (especially towards the end of the passage) Porphyry makes clear which of them he takes to be involved, in several cases it is very hard to tell.

³⁷⁰ Here the ‘excess (*hyperochē*) and deficiency’ must be an absolute quantity; e.g. 12 ‘exceeds’ 8 by 4, and 8 is ‘deficient’ of 12 by 4 units. It cannot be conceived in Porphyry’s usual way, in its relation to the ratio’s terms, since it is not the same fraction of the greater term as it is of the smaller. Eratosthenes (or Porphyry on his behalf) evidently equates the *hyperochē* with the ‘difference’, and the difference with the interval (*diastēma*). Exactly how these correspondences are to be understood is at this stage unclear; as Porphyry says at the end of the paragraph, ‘he has not established what is called an interval’. Plainly it makes no sense to equate the difference between a ratio’s terms with the corresponding musical interval. But the following paragraph suggests that Eratosthenes was not using the word *hyperochē* to refer to the difference between a ratio’s terms, but only – in effect – as a synonym for *diastēma*.

³⁷¹ Porphyry seems to be referring to a passage of Eratosthenes’ *Platonikos*, cited at Theo Smyrn. 81.17–82.5 Hiller. But that passage contains substantially more detail, and Porphyry probably did not have it in front of him, since he was apparently thinking of only the last few lines. If he had remembered the remainder he might perhaps have omitted the second part of his criticism.

Ἀπὸ δὴ τούτου κινηθέντες τινὲς τῶν μετ' αὐτὸν διάστημα ἐκάλεσαν εἶναι ὑπεροχὴν, ὡς Αἰλιανὸς ὁ Πλατωνικὸς καὶ Φιλόλαος δ' ἐπὶ πάντων τῶν διαστημάτων προσηγορίαν, ἀλλὰ καὶ Θράσυλλος ἐν τῷ Περὶ τῶν ἑπταχόρδων ἐπὶ τῆς διαφορᾶς εἶναι τῶν φθόγγων

(15) τάττει τὸ διάστημα, γράφων οὕτως.

“Τὸ δὲ διάστημα λέγουσιν αὐτὴν τὴν διαφορὰν τὴν γινομένην πρὸς ἀλλήλους δύο φθόγγων τῶν ἀνομοίων, οἷον ἕαν ὁ μὲν ᾗ βαρὺς, ὁ δ' ὀξύς, ἢ παρ' ἀλλήλους διαφορὰ διάστημα προσαγορεύεται. διαφέρει δὲ λόγος ὑπεροχῆς· καὶ κατὰ τοῦ ὄντος γὰρ διπλήχους καὶ πηχυαίου ἢ μὲν ὑπεροχὴ κατὰ μονάδα θεωρεῖται· ὁ δὲ λόγος διπλασίων τοῦ μείζονος ὅρου

(92) πρὸς τὸν ἐλάσσονα. καὶ λόγος ὁ αὐτὸς ἐστὶ τοῦ ἕξ πρὸς τὰ τρία καὶ τοῦ δύο πρὸς ἕν· αἱ δ' ὑπεροχαὶ ἄνισοι· ἐν μὲν γὰρ τοῖς ἕξ πρὸς τὰ τρία τριάς ὑπερέχει, ἐν δὲ τοῖς δύο πρὸς ἕν μονὰς ὑπεροχὴ. καὶ ἐπὶ τῶν διαφορόντων δὲ μεγεθῶν τῆς αὐτῆς ὑπεροχῆς οὔσης μείζων ὁ λόγος ἐπὶ τῶν ἐλασσόνων ἤπερ ἐπὶ τῶν μειζόνων, οἷον τοῦ ἕξ ἀριθμοῦ πρὸς τὰ δύο λόγος τριπλάσιος καὶ ἡ ὑπεροχὴ τῶν ὅρων μονάδες τέσσαρες· τῶν δὲ

11 μετ' αὐτῶν p 12 Φιλόλαος] fortasse Φίλισκος (cfr. 3.7) 13 προσηγορίαν] προσηγόρευσε coni. Alexanderson 14 Περὶ τῶν ἑπταχόρδων scripsi Περὶ τοῦ ἑπταχόρδου Düring Περὶ τῶν ἑπτὰ μόνων codd. 19 πηχυαίου] διπηχυαίου V¹⁸⁷

3 ante ὑπεροχὴ add. ἡ G

Prompted by this man [Eratosthenes], then, some of those who came after him called the interval 'the excess',³⁷² as did Aelianus the Platonist and Philolaus,³⁷³ for instance, in speaking of every interval; and Thrasyllus too, in his *On Heptachords*,³⁷⁴ specifies that the interval is the difference between | the notes, writing as follows.

They say that the interval is the difference between two unlike notes in relation to one another; thus if one note is low and the other is high, the difference between them is called an interval. A ratio is different from an excess. For if there is a two-cubit length and a one-cubit length the excess | is identified as a unit; but the ratio of the greater term to the smaller is double. And the ratios of 6 to 3 and of 2 to 1 are the same, but the excesses are different, since in the ratio 6 to 3 what is in excess is a triad, while in the ratio 2 to 1 the excess is a unit. With different magnitudes where the excess is the same, the ratio between the | smaller magnitudes is greater than that between the greater magnitudes; the ratio of the number 6 to 2, for example, is triple, and the excess of one term over the other is 4 units, whereas in the

[92D]

³⁷² Here again the 'excess', *hyperochē*, must be the absolute amount by which one magnitude exceeds another, the quantitative 'difference' between them.

³⁷³ References to the interval as 'the excess' do not occur in any surviving passage of Aelianus; in a relevant context at 35.13–23 he repeatedly connects *diastēma* with *diaphora*, not with *hyperochē*. The reference to Philolaus poses a problem, since if he is Philolaus of Croton, the well-known Pythagorean of the late fifth century BC, he patently did not come after Eratosthenes; nor does the word *hyperochē*, 'excess', occur in his surviving fragments. For discussion see Huffman (1993): 377–80. He suggests that the Latin *differentia*, which appears in a suitable context in material attributed to Philolaus at Boethius *De inst. mus.* 3.5, is a translation of the Greek *hyperochē*, and that this is what Porphyry had in mind. In his opinion (368–74) this passage does not record a genuine doctrine of the fifth-century Philolaus, but is associated with the later tradition of commentaries on Plato's *Timaeus*; and he therefore suggests that 'the Philolaus Porphyry has in mind is the Philolaus created in that tradition' (379). This might be correct, though I am not convinced that the 'Philolaus' material in Boethius is spurious (see Barker (2007): 271–83); but it would not explain Porphyry's inclusion of this Philolaus among those who came after Eratosthenes unless he knew, and assumed that his readers would know, that the writer was not the fifth-century figure. Yet Boethius' source, Nicomachus, evidently supposed that it was indeed the early Pythagorean, and it seems rather unlikely that Porphyry thought otherwise. Even if he did, only extraordinarily well-informed and perceptive readers could have inferred from the present passage that the allusion is to the hypothetical figure of the later period; it is overwhelmingly likely that they would automatically have treated an unqualified reference to Philolaus as a reference to Philolaus of Croton. I suspect, in fact, that the name is an error by a copyist, who carelessly substituted a well-known name for one that looked similar but was less familiar. In that case there is an obvious candidate; the name should be Philiscus, a musical theorist known only from 3.7 above, where he is listed among those who came later than Aristoxenus.

³⁷⁴ Here and at 96.16 the MSS give the title of this work in various nonsensical forms. Düring's emendations produce the title *On the Heptachord*, which is intrinsically very plausible; but since the MSS tradition includes plural elements in both passages, *On Heptachords* seems to me more likely. The implication that there were several kinds of heptachord is confirmed by other texts, e.g. Nicom. *Harm.* 241.3–242.11, 252.4–254.2 Jan (incorporating Philolaus fr. 6a Huffman), [Arist.] *Probl.* 922b.

κ' πρὸς τὰ ις' ἢ μὲν ὑπεροχὴ μονάδες δ' ἢ αὐτῇ, ὁ δὲ λόγος ἕτερος ἐπὶ δ' ἐλάσσων.

- (10) "Οτι μὲν οὖν διαφέρει λόγος ὑπεροχῆς, δηλον· ὅτι δ' ὁ λόγος καὶ ἡ σχέσις τῶν πρὸς ἄλληλα συμβλητῶν ὄρων καλεῖται καὶ διάστημα, παραστήσομεν.

- Εὐρίσκομεν γὰρ συνήθως παρὰ τοῖς ἀρχαίοις κατὰ τοῦ λόγου τιθέμενον τὸ διάστημα. ὁ γοῦν παρὰ τῷ θειοτάτῳ Πλάτῳ Τιμαίος "ἡμιολίων" φησί, "διαστάσεων καὶ ἐπιτρίτων καὶ ἐπογδῶν γενομένων
(15) ἐκ τούτων τῶν δεσμῶν, τῷ τοῦ ἐπογδῶ διαστήματι τὰ ἐπίτριτα πάντα συνεπληροῦτο, λέειπὼν αὐτῶν ἐκάστου μόριον, τῆς δὲ τοῦ μορίου ταύτης διαστάσεως λειφθείσης ἀριθμοῦ πρὸς ἀριθμὸν ἐλαχίστους ἐχούσης τοὺς ὄρους ζ' καὶ ν' καὶ σ' πρὸς γ' καὶ μ' καὶ σ'."

- Διὰ δὲ τῶν εἰρημένων τὰ διαστήματα, οὐ τὰς ὑπεροχάς, ἀλλὰ τοὺς
(20) λόγους συνήθως φησὶν ὡς καὶ Δημητρίῳ καὶ Παναιτίῳ δοκεῖ τοῖς μαθηματικοῖς. ἀντὶ γὰρ τοῦ εἰπεῖν ἡμιολίων δὲ λόγων ἡμιολίων εἶπε διαστάσεων. καὶ τῶν κανονικῶν δὲ καὶ τῶν Πυθαγορείων οἱ πλείους τὰ διαστήματα ἀντὶ τῶν λόγων λέγουσιν. βεβαιοῖ δὲ καὶ τὸ προκείμενον καὶ Παναιτίος ἀποδείξας, ὅτι καὶ αὐτὸς Ἑρατοσθένους κατεχρήσατό που
(25) τῷ διαστήματι ἀντὶ τοῦ λόγου. ἀλλὰ καὶ Δημήτριος ἐν τῷ Περὶ λόγου συναφῆς μὴ ἀρεσκόμενος τοῖς ὑπὸ Διοδώρου λεγομένοις

16 συνεπληροῦτο λέειπὼν codd. Plat. Paris. 1807, Vindob. 54, Vindob. 21, Procl. *In Tim.* III.187.12 συνεπλήρου τὸ λέειπον **gV**¹⁸⁷, Vindob. 55, Plut. *De an. procr.* 1020B ἀνεπλήρου τὸ λέειπον **A** 17 ἐλαχίστους **A** ἐλάσσονας ceteri 18 ζ' καὶ ν' καὶ σ' πρὸς γ' καὶ μ' καὶ σ' **A** ζ' καὶ ἡ' καὶ μ' καὶ σ' **gV**¹⁸⁷

case of 20 to 16 the excess, 4 units, is the same, but the ratio, the epitetartich [i.e. 5:4], is different and smaller.

It is clear, then, that a ratio is different from an excess. But we shall point out too that the ratio and the | relation between terms compared with one another is also called an interval. For we find 'interval' used habitually by the ancient writers to refer to a ratio. Thus Timaeus, in the work of the supremely god-like Plato,³⁷⁵ says: 'From these links there arose hemiolic, epitritich and | epogdoic distances (*diastaseis*); and he filled out all the epitritiches with the interval (*diastēma*) of the epogdoic, leaving a part of each of them, where the distance left for this part had as its smallest³⁷⁶ boundaries, number to number, 256 to 243'.³⁷⁷

To judge from what he has said, he habitually gives the name 'intervals' not to the excesses but | to the ratios, as the mathematicians Demetrius and Panaetius also agree; for instead of saying 'hemiolic ratios' he says 'hemiolic distances'.³⁷⁸ And most of the *kanonikoi* and of the Pythagoreans also say 'intervals' instead of 'ratios'. Panaetius also confirms this point by showing that even Eratosthenes himself sometimes used | 'interval' in place of 'ratio'.³⁷⁹ Again, Demetrius in his *On the Combination of Ratio*,³⁸⁰ disagreeing with things said by Diodorus,³⁸¹ applies 'interval' to the same

³⁷⁵ 'Supremely god-like' is an attempt to capture the force of the superlative *theiotatōi*. As an anonymous reader points out, this is one of the few passages in the commentary that clearly betray Porphyry's Platonist commitments.

³⁷⁶ Reading *elachistous*, 'smallest', with one MS; the others have *elassonas*, 'smaller', printed by Düring. The sense, I take it, is that 256:243 represents the ratio in its lowest terms. Neither word occurs here in our MSS of Plato.

³⁷⁷ Plato *Timaeus* 36a–b.

³⁷⁸ Porphyry quite reasonably assumes that in Plato's usage, *diastasis* ('distance') and *diastēma* ('interval') are synonymous. He might also have pointed out that Plato writes directly of the 'interval (*diastēma*) of the epogdoic'. At a stretch, the clause about Demetrius and Panaetius might mean rather that they themselves followed Plato's usage (as indeed they apparently did; cf. 94.20–6). But the sense given in the translation is both linguistically and contextually more likely, and it is clear that both these writers commented on usages found in earlier mathematical sources (92.23–8). Demetrius may be the Demetrius described by Proclus as a geometer and as one of Porphyry's teachers, *In Plat. Rep.* II.23.14. We learn at 92.25–6 that he wrote on issues connected with ratios. Panaetius had similar interests; to judge by the title of his treatise (65.21–3) the topic under discussion here was central to its agenda.

³⁷⁹ 'Even' Eratosthenes, because he was reported at 91.4 above as denying an equivalence between *diastēma* and *logos*. For discussion of Eratosthenes' contributions in harmonic theory see Creese (2010): 178–209.

³⁸⁰ The title *Peri logou sunaphēs* could also be rendered as *On the Unification of Ratio*, or possibly *On the Construction of Ratio*. Precisely what was intended is not clear.

³⁸¹ This is enigmatic, since no one called Diodorus has yet been mentioned. His identity is uncertain; possibly he is the mathematician of that name mentioned by Achilles Tatius (*Isag.* 2.1). There is nothing to recommend the view that he is the fourth-century quasi-Pythagorean Diodorus of Aspendus, on whom see Burkert (1972): 202–4.

- κατὰ τοῦ αὐτοῦ τὸ διάστημα τῷ λόγῳ τίθεται, καὶ ἄλλοι δὲ πολλοὶ τῶν παλαιῶν οὕτω φέρονται. καθάπερ καὶ Διονύσιος ὁ Ἀλικαρνασσεύς καὶ Ἀρχύτας ἐν τῷ Περὶ μουσικῆς καὶ αὐτὸς ὁ στοιχειωτῆς Εὐκλείδης ἐν τῇ Τοῦ κανόνος κατατομῇ ἀντὶ τῶν λόγων τὰ διαστήματα λέγουσιν. ὁ μὲν γὰρ Εὐκλείδης λέγει· “τὸ διπλάσιον
- (30) διάστημα σύγκειται ἐκ δύο τῶν μεγίστων ἐπιμορίων” καὶ “ἐπιμορίου διαστήματος οὐδεις μέσος ἀνάλογον ἐμπίπτει” ἀριθμός, καὶ τὰ αὐτὰ ἔσται θεωρήματα, ὧν τὰς ἀποδείξεις ὡς ἐν τοῖς οἰκείοις τόποις προϊόντος τοῦ λόγου παραστήσομεν ὑπομνήσεως ἕνεκεν.
- (5) Ἀρχύτας δὲ περὶ τῶν μεσοτήτων λέγων γράφει ταῦτα.
“Μέσαι δ’ ἐντι τρῖς τᾶ μουσικᾶ. μία μὲν ἀριθμητικὰ, δευτέρα δ’ ἁ γεωμετρικὰ, τρίτα δ’ ὑπεναντία, [ἂν καλέοντι ἁρμονικάν]. ἀριθμητικὰ μὲν, ὅκκα ἔωντι τρεῖς ὅροι κατὰ τὰν τοίαν ὑπεροχάν ἀνάλογον, ᾧ πρᾶτος δευτέρου ὑπερέχει, τούτῳ δευτέρος τρίτου ὑπερέχει. καὶ ἐν ταῦτα <τᾶ>
- (10) ἀναλογίᾳ συμπίπτει εἶμεν τὸ τῶν μειζόνων ὅρων διάστημα μείον, τὸ δὲ τῶν μειόνων μείζον. ἁ γεωμετρικὰ δ’ ὅκκα ἔωντι οἷος ὁ πρᾶτος ποτὶ τὸν δευτέρον, καὶ ὁ δευτέρος ποτὶ τὸν τρίτον. τούτων δ’ οἱ μείζονες ἴσον ποιοῦνται τὸ διάστημα καὶ οἱ μείους. ἁ δ’ ὑπεναντία, ἂν καλοῦμεν ἁρμονικάν, ὅκκα ἔωντι <τοῖοι, ᾧ> ὁ πρᾶτος ὅρος ὑπερέχει τοῦ δευτέρου αὐταύτου μέρει, τούτῳ ὁ μέσος τοῦ τρίτου ὑπερέχει τοῦ τρίτου μέρει. γίνεται δ’ ἐν ταῦτα τᾶ ἀναλογίᾳ τὸ τῶν μειζόνων ὅρων διάστημα μείζον, τὸ δὲ τῶν μειόνων μείον.”
- Ἐν γὰρ τούτοις τὸν λόγον τῶν ὅρων διάστημα κέκληκεν, οὐ τὴν ὑπεροχὴν. οἱ δ’ Ἀριστοξένειοί φασι τὰ τῶν διαστημάτων μεγέθη λέγεσθαι
- (20) κατὰ τὴν ἀπόστασιν τῶν ὀξυτάτων καὶ βαρυτάτων, οὐ κατὰ τὴν τοῦ

2 μέσος Eucl. μίαν gV¹⁸⁷ μέσον A 3 τὰς Alexanderson αἱ codd. 6 ἐντι τρῖς Wallis ἐντι τρισὶ GV¹⁸⁷ μία G μίαν V¹⁸⁷ 7 [ἂν καλέοντι ἁρμονικάν] del. Huffman 8 τὰν τοίαν Blass τὰν τωίαν GV¹⁸⁷ τὰν τῶ A ᾧ Blass ὧν codd. 9 τούτῳ Düring τωῦτῳ Blass τούτου codd. ἐν ταῦτα <τᾶ> Mullach ἐνταῦθα codd. 10 εἶμεν cfr. Huffman (2005): 154 ἤμεν Düring 11 ἁ Wallis τὰ codd. om. Blass οἷος Blass οἷς GV¹⁸⁷ εἰς p 14 <τοῖοι ᾧ> add. Diels 15 αὐταύτου Düring αὐταῦτω Blass ἀνταύτου gV¹⁸⁷ αὐτὰν τοῦ A 16 ἐν ταῦτα] ἐνταῦθα p

thing as 'ratio', and many other ancient writers do the same. Thus Dionysius of Halicarnassus,³⁸² Archytas in his *On Music* and Euclid himself, the author of the *Elements*, | in his *Section of the Canon*, speak of 'intervals' in place of 'ratios'. For Euclid says 'the double interval is composed of the two greatest epimorics', and 'in an epimoric interval no mean number falls proportionately'³⁸³ (these are the same theorems whose proofs we shall set out by way of a reminder in the appropriate places, as the discussion proceeds³⁸⁴); | and when Archytas discusses the means, he writes as follows.³⁸⁵ [93D]

There are three means in music; one is the arithmetic, the second the geometric and the third the subcontrary, which they call 'harmonic'.³⁸⁶ There is an arithmetic mean when there are three terms which are proportional in that the excess is of the following sort: the second exceeds the third by the same amount as that by which the first exceeds the second. In this | proportion it turns out that the interval between the greater terms is smaller, and that between the smaller terms is greater. There is a geometric mean when they are such that as the first is to the second, so is the second to the third. With these the interval made by the greater terms is equal to that made by the smaller. There is a subcontrary mean, which we call 'harmonic', when they are such that the part of the third by which the middle term exceeds the third | is the same as the part of the first by which the first exceeds the second. In this proportion the interval between the greater terms is greater, and that between the smaller terms is smaller.

In these statements he applies the term 'interval' to the ratio between the terms, and not to the excess. But the Aristoxenians say that the magnitudes of the intervals are specified | on the basis of the distance separating the

³⁸² This is not, of course, the famous literary theorist and historian of that name, who was neither a mathematician nor a musical theorist. (He does indeed use the word *diastēma* in several passages, sometimes in a musical sense (see *Lysias* 11, *De comp. verb.* 11 and 26), but gives no hint in any of them that he is thinking of musical intervals as ratios.) This Dionysius must be the one described at 37.15 as 'Dionysius the music-theorist', and mentioned below at 94.25 (where he is credited again with the usage indicated here), 96.11 and 104.14. The entry on him in the *Suda* records that he too was from Halicarnassus.

³⁸³ [Eucl.] *Sect. can.* propositions 6 and 3. ³⁸⁴ See 98.16–103.25 below.

³⁸⁵ For a thorough discussion of this passage (Archytas fr. 2 DK) see Huffman (2005): 162–81. Alexander's emendations at 93.15 are based on a misunderstanding.

³⁸⁶ Huffman (2005): 173) argues that the phrase 'which they call "harmonic"' should be deleted here, on the grounds that if it is retained, 'they' must presumably refer to people other than Archytas (perhaps mentioned in an earlier remark), and in that case it conflicts with 'we' in the penultimate sentence. He suggests that it is a commentator's note based on Archytas' statement that 'we' call this mean harmonic, and that when the commentator says 'they' he is referring to Archytas and his associates.

- μείζονος πρὸς τὸ ἔλαττον ὑπεροχὴν. ἐπεὶ γὰρ τὸ ἀπὸ μέσης ἐφ' ὑπάτην ἐστὶ διάστημα, δηλὸν ὡς ἡ μέση τῆς ὑπάτης διέστηκεν· εἰ δὲ διέστηκεν, ἀνὰ μέσον τις αὐτῶν ἑτερός ἐστι τόπος τῶν περιεχόντων φθόγγων τὸ διάστημα, ὃν τρόπον ἐπὶ κιόνων ἢ τοίχων ἢ δοκῶν ἢ καμπτήρων ἢ πό-
- (25) λεων ἢ ἄλλου τινὸς τῶν διεστάναι λεγομένων οὐδὲν ἄλλο θεωροῦμεν διάστημα ἢ τὸν ἀνὰ μέσον αὐτῶν τόπον. ὅθεν καὶ Ἀριστόξενος ὠρίσατο τὸ μεταξύ δύο φθόγγων ἀνομοίων τῇ τάσει λέγων εἶναι τὸ διάστημα· διὸ καὶ μεγέθει γνωρίζεται πάντως.
- (94) Σαφηνιστέον δὲ τὰ περὶ τοῦ λόγου καὶ τοῦ διαστήματος ἔτι μᾶλλον· ὅτι μὲν τοῖνυν ὁ λόγος ἐν διαφόροις γίνεται ὅροις, ὁμαγενέσι δὲ πάντως, καὶ ἐν ἀδιαφόροις, ὡς Εὐκλείδῃ δοκεῖ, δειχθήσεται· διάστημα δ' ἐν τοῖς διαφέρουσι μόνον, φανερόν. δεικτέον δ' ὅπως καὶ ἐν ποσοῖς καὶ
- (5) πηλίκοις θεωρεῖται τὸ διάστημα. ἐν μὲν γὰρ τοῖς ἀνίσοις κατὰ μέγεθος διάστημα λέγουσιν τινες τὴν κατὰ ποσότητα ὡς εἴρηται ὑπεροχὴν· ἐν δὲ τοῖς ἐπιδεχομένοις τὴν κατὰ ποιότητα σύγκρισιν διάστημα λέγεται ἢ κατὰ τὴν ἐπίτασιν τῆς ἐν αὐτοῖς ποιότητος διαφορά, οἷον δυοῖν λευκῶν ἀνομοίων διάστημα λέγεται ἢ κατὰ τὴν ἐπίτασιν τῆς λευκότητος ἐν αὐ-
- (10) τοῖς διαφορά. καὶ γὰρ ἐστὶ ἡ μὲν ὁμοιότης ὥσπερ ἰσότης. ἐν τοῖς κατὰ θέσιν διαφέρουσιν ὑφίσταται τοπικὸν διάστημα· τὸ γὰρ μεταξύ δυοῖν τινων θέσεων διαφερόντων τῷ τὸ μὲν ἐνθάδε, τὸ δ' ἐνθάδε κεῖσθαι λέγεται διάστημα, ὃ καὶ ὀριζόμενοι φασιν εἶναι γραμμῆς χώραν, ὡσανεὶ γὰρ τόπος τῆς μεταξύ κατ' εὐθείας οὕτως ἐπινοεῖται.
- (15) Γίνεται δὲ καὶ ἐν κινουμένοις διάστημα ἢ κατὰ τὴν ἐπίτασιν τοῦ ἐν αὐτοῖς τάχους διαφορά. οὕτω δὲ καὶ κατὰ τοὺς ἀνισοτόνους “τὴν διαφοράν τοῦ ὀξυτέρου φθόγγου παρὰ τὸν βαρύτερον διάστημα καλοῦσι· καὶ οὕτως ὀρίζονται διάστημα δυεῖν φθόγγων ἀνομοίων ὀξύτητι καὶ βαρύτητι τὸ διαφέρον.” καὶ οὐ πάντως τὸ διάστημα ἤδη καὶ λόγος.

22 ante ἢ add. μὲν G 26 τόν] τοῦ typographic error Düring

11 ὑφίστανται p τοπικόν Wifstrand τὸ ποικίλον codd. 12 τό⁹⁴ — 13 διάστημα om. G
14 κατ' Wifstrand καὶ codd. ἐπινοεῖται Wifstrand ἐπινόηται codd. 18 ante διάστημα add. τό
p

highest and lowest <notes>, not by the excess of the greater over the smaller.³⁸⁷ For since that which is from *mesē* to *hypatē* is an interval, it is clear that *mesē* is separated from *hypatē*. And if it is separated, the interval is a space between them which is other than the notes that surround it, in the same way that in the case of pillars or walls or beams or turning-points or cities | or any other things that are said to be separated, what we understand as an interval is nothing other than the space between them. That is why Aristoxenus, in his definition, said that an interval is what lies between two notes that are unlike in pitch, and hence it is always recognised by its size.³⁸⁸

We must clarify the issues about ratio and interval still further. It will be shown that ratio holds between different terms that are always of the same kind, and in Euclid's opinion between ones that do not differ, too; whereas it is clear that there is an interval only between terms that differ. It must also be shown how the interval is thought of in terms of | quantities and sizes. For in the case of things that are unequal in magnitude, some people, as we have stated, call the quantitative excess an interval. But in things that can be compared in respect of quality, the name 'interval' is given to the difference in the intensity of the quality they have. Thus the difference in the intensity of whiteness in two dissimilar white things is said to be | the interval between them, for similarity is, as it were, equality. Between things that differ in position there is an interval in respect of place. For what is between two things that differ in position, in that the one lies here and the other there, is called an interval, which people define as the location of a line, as though it were thought of as the place of a straight line between them.

| With things that are moving, the interval between them is the difference in the intensity of their speeds. Thus in respect of unequal-toned sounds too, 'people call the difference between the higher note and the lower an interval; and so they define an interval as the difference between two notes that are unlike in height and depth';³⁸⁹ and an interval is not necessarily

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³⁸⁷ This is correct and important. Aristoxenus conceives pitches as points on a continuum, and intervals as the spaces between them. He completely rejects the representation of notes as magnitudes and intervals as ratios; and the size of an Aristoxenian interval is quite distinct from the 'excess' of the greater term over the smaller of the ratio that a mathematical theorist would assign to that interval. Thus the size of the fifth is greater than that of the fourth, but when their ratios are expressed in their lowest terms, as 3:2 and 4:3, the 'excess', conceived as an absolute quantity, is the same in each case. Obvious though this is, the two conceptions are sometimes confused, as they are by Ptolemy at *Harm.* 20.23–21.8; and despite the distinction which he draws here, Porphyry appears to follow him in this error in his discussion of that passage (126.23–127.23).

³⁸⁸ Aristox. *El. harm.* 15.24–5.

³⁸⁹ A loose quotation from Aelianus, 35.15–17 and 21–2 above.

- (20) ὅταν οὖν τις βούληται καὶ τὴν ὑπεροχὴν διάστημα καλεῖν, ὥς εἶναι τὸ διάστημα κοινὸν ὄνομα καὶ τῆς κατὰ τὸ ποσὸν ὑπεροχῆς, οὐδεὶς φθόνος. τὸ δὲ ὑπολαμβάνειν, ὅτι ἰδίως ἐπὶ μὲν τῆς ὑπεροχῆς διάστημα λέγεται, οὐκέτι δὲ καὶ ἐπὶ τοῦ λόγου καλεῖται τὸ διάστημα, πῶς οὐκ ἄτοπον
- (25) εἶναι δόξειε διὰ τὰ προειρημένα Δημητρίῳ τε καὶ Παναιτίῳ, Ἀρχύτῃ τε καὶ Διονυσίῳ καὶ αὐτῷ τῷ Στοιχειωτῇ καὶ ἄλλοις πολλοῖς κανονικοῖς, καταχρησαμένοις τῷ διαστήματι ἀντὶ τοῦ λόγου;

Πέφηνε μὲν οὖν, ὅπως καὶ ἀντὶ τοῦ λόγου τὸ διάστημα λαμβάνεται, καὶ οὐ πάντως λόγος διαστήματος ἕτερον, ὥς δοκεῖ τισι. τὰ δὲ περὶ τοῦ διαστήματος εἰρημένα συγκεφαλαιωσώμεθα νῦν. τρεῖς γὰρ αἰρέσεις

- (30) ἢ πάντως δύο γεγόνασιν περὶ τούτων.

Οἱ μὲν γὰρ τὸν λόγον καὶ τὴν σχέσιν τῶν πρὸς ἀλλήλους συμβλητῶν ὄρων τὸ διάστημα καλοῦσι, καθ' οὓς ὅρους ὁ ἐπίτритος λόγος καὶ ἡμιόλιος καὶ πάντες οἱ τοιοῦτοι ἀδιαφόρως λόγοι τε καὶ διαστήματα κλη-

- (95) θήσονται, ἅπερ καὶ Δημήτριος κατὰ δύναμιν καὶ οὐ τοπικὰ κέκληκεν. εἰ δὲ καὶ ὁ τῆς ἰσότητος τῶν ὄρων λόγος διάστημα καλεῖται κατ' αὐτούς, οὐ σαφηνίζουσιν.

Οἱ δὲ τὴν διαφορὰν τῶν ὁμογενῶν τε καὶ πρὸς ἀλλήλους συμβλητῶν

- (5) ὄρων τὸ διάστημα λέγουσι, καθ' οὓς τοῦ λόγου διαφέρει τὸ διάστημα καὶ ἐν μόνοις τοῖς διαφέρουσιν ὑφέστηκε δ' ὅροις. ἔστι δ' ἡ διαφορὰ ἐν μὲν τοῖς διαφέρουσιν ἀριθμοῖς ἢ κατὰ ποσότητα ὑπεροχῇ τὸ διάστημα, ἐν δὲ τοῖς κατὰ μέγεθος διαφέρουσιν ἢ κατὰ πηλίκον ὑπεροχή, ἐν δὲ τοῖς ποιοῖς ἢ κατὰ τὴν ἐπίτασιν τῆς διαφορᾶς, ἐν δὲ τοῖς κατὰ θέσιν
- (10) διαφέρουσιν διάστημα ἔστιν ἢ κατὰ τόπον διάστασις, ἐν δὲ τοῖς κινουμένοις ἢ κατὰ τὴν διαφορὰν τῆς ἐπιτάσεως τοῦ τάχους τῶν κινουμένων, ἐν δὲ τοῖς ἄλλοις ὁμογενέσι τε καὶ συμβλητοῖς ἄλλο τὸ διάστημα.

Οἱ δ' Ἀριστοξένειοι τοπικὸν τίθενται τὸ διάστημα· τόπον γὰρ εἶναι φωνῆς ἀκίνητον, ἐν ᾧ κινούμεν τὴν φωνὴν πηλίκον τι μέγεθος, διὰ τῆς

- (15) τῶν ποδῶν διαφόρου θέσεως τοῦ τόπου, ἐν ᾧ βαδίζουσιν, ἀφορίζουσιν· διὸ καὶ διαστάντες μὲν ἐπὶ πλέον τὰ διαβήματα μεῖζον διάστημα τοῦ

27 λαμβάνεται Alexanderson λαμβάνηται codd.

4 οἱ Düring εἰ codd.

also a ratio.³⁹⁰ | Then when someone wants to call the excess an interval, on the grounds that ‘interval’ is a name shared by the excess in quantity too, we have no quarrel with them. But how could it not seem absurd to suppose that ‘interval’ refers exclusively to the excess, and that the name ‘interval’ is never given to the ratio, in view of the statements we have mentioned by Demetrius and Panaetius, Archytas | and Dionysius, by the writer of the *Elements* himself, and by many other *kanonikoi*, who use ‘interval’ in place of ‘ratio’?³⁹¹

It has become clear,³⁹² then, that ‘interval’ is adopted in place of ‘ratio’, and that a ratio is not always different from an interval, as some people think. Let us now sum up what has been said about the interval. There are three schools of thought about it, | or at any rate two.

Some people give the name ‘interval’ to the ratio and the relation between two mutually comparable terms; in respect of these terms the epitritic ratio and the hemiolic and all others of that sort are indifferently called ratios and intervals. Demetrius calls them intervals in respect of attribute (*dynamis*), and not in respect of place. But they do not make clear whether, in their usage, the ratio of equality between terms is also called an interval.

[95D]

Others speak of the interval as the difference between terms that are of the same kind | and are mutually comparable; according to them an interval differs from a ratio, and exists only between terms that differ. In different numbers the difference – the interval – is the excess in quantity; in things differing in magnitude it is the excess in size; in things with qualities it is the excess in the intensity of the attribute; in things differing | in position the interval is the distance in space; in moving things it is the excess constituting the difference in intensity of the speeds of the things that are moving; and in other things that are of the same kind and are mutually comparable, the interval is something else.

The Aristoxenians make the interval spatial. For they say that there is an unmoved space belonging to the voice, in which we move the voice through a magnitude³⁹³ of some size; and they illustrate this by the | different placement of their feet in the space in which they walk. Thus by separating their steps more widely they mark off a larger interval in the space, and by

³⁹⁰ A verbal reminiscence of Aelianus at 35.22–3 (‘and an interval does not necessarily also possess concordance’), though the sense is quite different. The sense of Porphyry’s statement is unclear. He might be alluding to the fact, noted at 94.6–10 above, that one can speak of a *diastēma* between qualities, or to the Aristoxenians’ usage in which the conceptions of *diastēma* and ratio are wholly unconnected. Or again, though in the context less probably, he might simply be reminding us that not all authorities sanctioned the use of the term *diastēma* where *logos* would be more strictly correct.

³⁹¹ In the passage quoted at 65.26–67.10, Panaetius’ usage varies; at 66.31 and 67.2 and 9 he writes *logos*, ‘ratio’, but at 67.3 he refers to the epogdoic (9:8) *diastēma*, ‘interval’.

³⁹² I take it that *πέφηνε* is used here intransitively; cf. LSJ s.v. *φείνω* A.III.2. ³⁹³ I.e. a distance.

τόπου ἀπολαμβάνουσι, ἐπ' ὀλίγον γάρ διαστάντες ὀλίγον. παρά διττὰς γάρ μετρητὰς πληλικότητος τὴν μουσικὴν φασὶ πραγματεύεσθαι· ἐν ῥυθμῷ μὲν περὶ χρονικάς, ἐν ἁρμονίᾳ δὲ περὶ τοπικάς.

- (20) Τοσαῦτα μὲν καὶ περὶ τοῦ διαστήματος, οὗ τὸ μὲν ἐστὶ τοπικόν, τὸ δὲ καθ' ὑπεροχὴν. χρησίμως οὖν τῆς τούτων ἡμῖν πραγματείας προεκτεθειμένης ἐπὶ τὰ ἐξῆς τῶν Πτολεμαίου ἐπανέλθωμεν, παραθέντες αὐτοῦ τὴν λέξιν.

[II] συμφωνίας δὲ ἡ μὲν αἴσθησις καταλαμβάνει τὴν τε διὰ τεσσάρων προσαγορευομένην καὶ τὴν διὰ πέντε, ὣν ἡ ὑπεροχὴ καλεῖται τόνος, καὶ τὴν διὰ πασῶν καὶ ἔτι τὴν τε διὰ πασῶν καὶ διὰ τεσσάρων καὶ τὴν διὰ πασῶν καὶ διὰ πέντε καὶ τὴν δις διὰ πασῶν. αἱ γὰρ ὑπὲρ ταύτας ἀφείσθωσαν ἡμῖν πρὸς τὴν παροῦσαν πρόθεσις. ὁ δὲ τῶν Πυθαγορείων λόγος [5] μόνην αὐτῶν τὴν διὰ πασῶν καὶ διὰ τεσσάρων ἀναιρεῖ ταῖς οἰκείαις ὑποθέσεσιν ἀκολουθῶν, ἃς ἔλαβον οἱ τῆς αἰρέσεως προστάντες ἀπὸ τῶν τοιούτων ἐννοιῶν.

- (25) Οἱ Πυθαγόρειοι τοὺς λόγους τῶν ἀριθμῶν, ἐν οἷς τὰ αἷτια τῶν ψόφων θεωρεῖται, ἀπεργάζεσθαι φασὶ τὰς συμφωνίας. τίνας δὲ λόγους ἐγκρίνουσιν καὶ τί ποτ' ἐστίν, ὃ λέγουσι, προϊόντος τοῦ λόγου δειχθήσεται. βουλόμενοι δὲ τῷ λόγῳ ἐρμηνεύειν τῇ ἀκοῇ <τόν> κατὰ τὰς συμφωνίας προσπίπτοντα ἤχον τὴν τε τοῦ συμφώνου καὶ τοῦ διαφώνου διαφορὰν παραστή-
(30) σαι, κρᾶσιν ὀξέος ψόφου καὶ βαρέος τὴν συμφωνίαν ἀπεδίδοσαν, οἱ δὲ συμπάθειαν, οἱ δ' ἐνότητα, οἱ δὲ λειότητα· καὶ τοῖς τοιούτοις ἐχρῶντο ὀνόμασιν παραστάσεως ἕνεκεν.

- (96) Ἄδραστος δ' ὁ Περιπατητικὸς ἐν τοῖς Εἰς τὸν Τίμαιον λέγει οὕτως· “Συμφωνοῦσι δὲ φθόγγοι πρὸς ἀλλήλους, ὧν θατέρου κρουσθέντως ἐπὶ τίνος ὀργάνου τῶν ἐντατῶν καὶ ὁ λοιπὸς κατὰ τινὰ οἰκειότητα καὶ συμπάθειαν συνεχεῖ. κατὰ τὸ αὐτὸ δ' ἅμα
(5) ἀμφοτέρων κρουσθέντων λεία καὶ προσηνῆς ἐκ τῆς κράσεως ἐξακούεται φωνή.”

24 ἀρχὴ τοῦ πέμπτου κεφαλαίου add. p 28 <τόν> addidi 28–29 προσπίπτοντα Alexanderson προσπίπτοντες codd. 29 τὴν Alexanderson τῇ codd. διαφορὰν Alexanderson διαφορᾷ codd.

in lemma: 11.5 ante πρὸς add. ὥς p

4–5 δὲ ἀμφοῖν ἅμα κρουσθέντων Theo Sm. 5 λεία] ἡδεῖα Theo Sm.

separating them by a small amount they mark off a small one. For they say that music conducts itself³⁹⁴ through two measurable quantities; in rhythm they are temporal and in melody (*harmonia*) they are spatial.

| So much, then, on the subject of the interval, of which one kind is spatial and the other corresponds to the excess.³⁹⁵ Now that our investigation of these matters has been presented as a useful preface, let us pass on to what Ptolemy says next, after setting down his words.

Perception accepts as concords the fourth, as it is called, and the fifth, the difference between which is called the tone, and also the octave plus a fourth, the octave plus a fifth and the double octave. Let us ignore for present purposes the concords that are bigger than these. The theory of the Pythagoreans rules out one of them, the octave plus a fourth, by following its own special assumptions, ones which the leaders of the school put forward on the basis of notions such as the following. Ptol. *Harm.* II.1–8

| The Pythagoreans say that the ratios of the numbers in which the causes of the sounds are thought to consist are responsible for producing the concords. Which ratios they include and what they mean will be shown as the discussion proceeds. But when they wanted to describe in words³⁹⁶ the sound [*ēchos*] that falls on the hearing in the case of the concords, and to explain the difference between the concordant and the discordant,³⁹⁷ | they asserted that concord is a blending of a high-pitched sound with a low one; some called it an affinity [*sympatheia*], some a unity [*henotēs*] and some a smoothness [*leiotēs*]. These are the sorts of terms they used as aids to understanding.

This is what Adrastus the Peripatetic says in his *On the Timaeus*. ‘Notes are concordant with one another if when either of them is played on a stringed instrument, the other also resonates with it through some sort of kinship or affinity [*sympatheia*]. And when they are | both played at the same time a smooth [*leios*] and agreeable voice is heard arising from the blend.’³⁹⁸

[96D]

³⁹⁴ The verb is *pragmateuesthai*, which in view of its use and that of its cognates by Porphyry and Ptolemy in other contexts may here mean ‘is addressed’, in the sense ‘is studied and investigated’.

³⁹⁵ It seems strange that at this point Porphyry omits any reference to treatments of ‘interval’ as interchangeable with ‘ratio’, on whose existence he has previously insisted so vigorously. But perhaps he takes this to be implicit in his remark, since the ratio can be directly inferred from the (proportional) size of the excess (see 88.17–27 above).

³⁹⁶ Or perhaps ‘in terms of ratio’ (the noun is *logos*); but ratios are not involved in what immediately follows.

³⁹⁷ I can make no sense of Düring’s text as it stands. I had guessed independently at the emendations proposed by Alexanderson and printed here, but I have no great confidence in them.

³⁹⁸ Also quoted, with minor variations, at Th. Smyrn. 50.22–51.4. The only significant difference is that the MSS of Theon have *hedeia*, ‘pleasant’ instead of Porphyry’s *leia*, ‘smooth’: Porphyry evidently needs the latter reading in order to support his contention that previous writers described concordance in terms of ‘smoothness’ as well as of ‘affinity’.

Αἰλιανὸς δ' ὁ Πλατωνικὸς Εἰς τὸν Τίμαιον
γράφων κατὰ λέξιν λέγει ταῦτα. “Συμφωνία δ' ἐστὶν δυεῖν φθόγγων
ὁξύτητι καὶ βαρύτητι διαφερόντων κατὰ τὸ αὐτὸ πτώσις καὶ κρᾶσις.

- (10) τῶν δὲ συμφωνιῶν ἕξ τὸν ἀριθμὸν οὐσῶν”—ἄς μόνας ὁ Πτολεμαῖος
κατηρίθμησε, παρεῖς τὰς λοιπὰς Ἀριστόξενος γὰρ καὶ Διονύσιος καὶ
Ἐρατοσθένης καὶ ἄλλοι πολλοὶ ὀκτὼ κατηρίθμησαν—“ἀπλᾶς μὲν
ἐκάλουν οἱ παλαιοὶ τήν τε διὰ τεσσάρων καὶ διὰ πέντε, συνθέτους δὲ τὰς
λοιπὰς. ἀπλᾶς δὲ λέγονται, ὅτι αἱ μὲν ἄλλαι ἐκ συμφωνιῶν καθεστήκα-
(15) σιν, αὗται δ' οὐ.”

Θράσυλλος δ' ἐν τῷ Περὶ ἑπταχόρδων ἀπλᾶς καὶ συμ-
φώνους οὐ μόνον τήν διὰ τεσσάρων καὶ διὰ πέντε κατηρίθμησεν, ὡς οἱ
πλείους τῶν μουσικῶν, ἀλλὰ καὶ τήν διὰ πασῶν. λέγει γὰρ οὕτως.

- (20) “τῆς δὲ συμφωνίας ἐστὶν εἶδη πλείω· ἡ μὲν γὰρ λέγεται διὰ πασῶν, ἡ
δὲ διὰ τεσσάρων, ἡ δὲ διὰ πέντε· συντάσσεται δ' οὖν ἐν ταῖς ἀπλᾶς.”

“Οἱ μὲν Πυθαγόρειοι τήν μὲν διὰ τεσσάρων συμφωνίαν συλλαβὴν ἐκά-
λουν, τήν δὲ διὰ πέντε δι' ὀξειᾶν, τήν δὲ διὰ πασῶν τῷ συστήματι, ὡς
καὶ Θεόφραστος ἔφη, ἔθεντο ἁρμονίαν. ἁρμονία δὲ κατὰ Θράσυλλον
‘τὸ συνεστηκὸς ἐκ δυεῖν τινων ἢ πλειόνων συμφῶνων διαστημάτων καὶ

- (25) ὑπὸ συμφῶνου περιεχόμενον’ ἁρμονίαι οὖν εἰσι τὰ συστήματα τὰ
περιεχόμενα ὑπὸ τῶν εἰρημένων συμφωνιῶν, ὥστε μέρη ἁρμονίας οἱ

16 ἑπταχόρδων G ἑπταχόρδω V⁸⁷p ἑπταμήνων A ἑπταχόρδου Düring
(2014), fortasse recte 25 περιεχόμενον Wallis περιεχομένου codd.

22 τήν^{sec.}] τῇ Raffa

In his *On the Timaeus*, Aelianus the Platonist says the following in exactly these words.

‘Concordance is the simultaneous incidence and blending of two notes that differ in height and depth. | Given that the concords are six in number’³⁹⁹ (these are the only ones that Ptolemy enumerates, omitting the remainder; for Aristoxenus and Dionysius and Eratosthenes counted eight⁴⁰⁰), ‘the ancient writers called the fourth and the fifth “simple” concords, and the others “compound”. They are called simple because the others are composed of concords, | while they are not.’

But Thrasyllus, in his *On Heptachords*,⁴⁰¹ counted not only the fourth and the fifth as both simple and concordant, as most of the musical experts do, but also the octave. For he speaks as follows: ‘There are many forms of concord; one is called the octave, another | the fourth and another the fifth.’ It is therefore included among the simple concords.⁴⁰²

The Pythagoreans called the concord of a fourth *syllabē* and the fifth *di’ oxeiān*, and to the system of the octave, as Theophrastus also says, they gave the name *harmonia*.⁴⁰³ According to Thrasyllus, a *harmonia* is ‘that which is put together from two or more concordant intervals and | is bounded by a concord’. Thus it is the systems bounded by the concords he mentions that are *harmoniai*, so that the concordant notes, both the boundary-notes and

³⁹⁹ The first sentence quoted appears also at 35.26–7 above, as part of a longer passage from Aelianus. But in that context the continuation is quite different, and an enumeration of the concords would break the train of thought. Unless Porphyry is misrepresenting him, Aelianus must have repeated the first sentence in another part of his treatise.

⁴⁰⁰ This parenthesis interrupts the quotation, and was evidently inserted by Porphyry himself. The eight concords recognised by Aristoxenus are fourth, fifth, octave, octave plus fourth, octave plus fifth, double octave, double octave plus fourth, double octave plus fifth; see *El. harm.* 19.30–21.19 (reading *ὀκτώ μεγέθη* with Macran at 21.18). We lack the relevant texts of Dionysius and Eratosthenes. Ptolemy concerns himself with nothing beyond the double octave, and so mentions only the first six.

⁴⁰¹ Cf. 91.13–14 above, with the note *ad loc.*

⁴⁰² Düring treats this sentence as part of the quotation from Thrasyllus, but this can hardly be right; the reference of ‘it’ would be altogether obscure. It seems to be Porphyry’s own comment, recording his distinctly shaky inference that since the octave appears with the fourth and the fifth in Thrasyllus’ basic list of concords, he must have regarded it as sharing their ‘simplicity’. Alternatively the inference may come from Aelianus; see further n. 404 below.

⁴⁰³ Cf. especially the second paragraph of Philolaus fr. 6 DK = fr. 6a Huffman. But these usages were probably not exclusively Pythagorean (cf. e.g. Hippocr. *De victu* 1.8.2). The explanations of the names given to the fourth and the fifth by Porphyry’s ‘instrumentalists’ in the next paragraph suggest that they were used by practical musicians, and this may well be correct. The use of the term *harmonia* to refer to the octave may come from the same source, though again it is first explicitly attested in the passage of Philolaus, since the ‘attunement’ (*harmonia*) of a stringed instrument typically spanned an octave. In any case the usage is very natural; the word’s root meaning is ‘a fitting-together’, and the octave can be conceived as fitting a set of notes and intervals together to form a coherent scale, or again as a fitting-together of the two ‘simple’ concords, the fourth and the fifth.

σύμφωνοι φθόγγοι οἱ τε περιεχόμενοι καὶ οἱ περιέχοντες, αὐτὰ δὲ τὰ συστήματα ἀρμονίαί.”

- (30) Συλλαβὴν δ' ἐκάλουν οἱ Πυθαγόρειοι τὴν διὰ τεσσάρων συμφωνίαν, ὡς Αἰλιανός φησιν, ὅτι πρώτη ἐστὶ συμφωνία συλλαβῆς τάξιν ἔχουσα.
- (97) τὸ δὲ διὰ πέντε τῆς συμφωνίας τῆς διὰ τεσσάρων ὡς ἐπὶ τὸ ὀξύτερον συγκεχωρηκός ἐκάλεσαν δι' ὀξειᾶν. κατὰ δὲ τοὺς ὀργανικοὺς λυρικοὺς συλλαβὴ εἴρηται ἀπὸ τοῦ λυρικοῦ σχήματος τῆς χειρός, ἐπειδὴ ἐν τῇ ἐπταχόρδῳ χρήσει ἡ πρώτη σύλληψις τῶν δακτύλων κατὰ τὸ διὰ τεσσάρων ἐγένετο σύμφωνον· ἐξ οὗν τοῦ συμβαίνοντος συλλαβὴν κεκληθῆναι,
- (5) <τὸ δὲ διὰ πέντε δι' ὀξειᾶν> ὅτι τοῦ διὰ πασῶν τὸ διὰ τῶν ὀξυτέρων τελούμενον φθόγγων σύμφωνον τὸ διὰ πέντε ἐστίν. ἃ μὲν οὖν
- (7) ἔδει περὶ τῆς τῶν Πυθαγορείων εὐρέσεως εἰπεῖν ταῦτα· παραθέντες
- (10) τὴν Πτολεμαίου λέξιν ἀρχόμεθα τῆς περὶ τῶν λοιπῶν κατὰ τὴν αἵρεσιν ἐξηγήσεως. ἐπάγει δὲ τοῖς προκειμένοις ὁ ἀνὴρ ταῦτα.

ἀρχὴν γὰρ οἰκειοτάτην ποιησάμενοι τῆς μεθόδου,
καθ' ἣν οἱ μὲν ἴσοι τῶν ἀριθμῶν παραβληθήσονται τοῖς ἰσοτόνοις φθόγ-
γοῖς, οἱ δὲ ἀνισοὶ τοῖς ἀνισοτόνοις, τούντεϋθεν ἐπάγουσιν, ὅτι καθάπερ [10]
τῶν ἀνισοτόνων φθόγγων δύο ἐστὶν εἶδη πρὸς ἄλληλα τὰ πρῶτα, τὸ τε
τῶν συμφῶνων καὶ τῶν διαφῶνων, καὶ κάλλιον τὸ τῶν συμφῶνων, οὕτως
καὶ τῶν ἀνίσων ἀριθμῶν δύο γίνονται πρῶται διαφοραὶ λόγων, μία μὲν
ἡ τῶν λεγομένων ἐπιμερῶν καὶ ὡς ἀριθμὸς πρὸς ἀριθμόν, ἑτέρα δὲ ἡ
τῶν ἐπιμορίων τε καὶ πολλαπλασίων, ἀμείνων καὶ αὕτη τῆς ἐκείνων κατὰ [15]

30 τάξιν Wallis τάσιν codd.

7 <τὸ δὲ διὰ πέντε δι' ὀξειᾶν> addidi 6-7 <ὅτι τοῦ διὰ πασῶν τὸ διὰ τῶν βαρυτέρων τελούμενον φθόγγων σύμφωνον τὸ διὰ τεσσάρων ἐστίν, καὶ δι' ὀξειᾶν> Düring <καὶ δι' ὀξειᾶν> vel <καὶ δι' ὀξειᾶν κεκληθῆναι> Alexanderson τοῦ Düring τῶν codd. 7-8 τὸν ὀξύτερον V¹⁸⁷ 8 ἀποτελούμενον conl. Düring φθόγγων Düring φθόγγου codd. 9 αἰρέσεως G p.c.

those between them, are parts of a *harmonia*, and the systems themselves are *harmoniai*.⁴⁰⁴

The Pythagoreans called the concord of a fourth *syllabē*, | so Aelianus says, because it is the first concord and has the status of a syllable; and they called the fifth *di' oxeiān* because it is placed next to the concord of a fourth on its upper side.⁴⁰⁵ But according to the instrumentalists who play the lyre, it [the fourth] was called *syllabē* from the shape of the lyre-playing hand, since in performance using the heptachord the first grip⁴⁰⁶ of the fingers spanned | the concord of a fourth.⁴⁰⁷ It was called *syllabē* on account of that fact; and the fifth was called *di' oxeiān* because the fifth is the concord that completes the octave through the higher notes.⁴⁰⁸ This, then, is what needed to be said about the Pythagorean discovery.⁴⁰⁹ After setting | down Ptolemy's words, we shall begin our exposition of the remaining views of this school. This is what he adds to the statements presented previously.

[97D]

They laid down a principle for their method which is entirely appropriate, according to which equal numbers should be associated with equal-toned notes, and unequal numbers with unequal-toned; and from this they argue that just as there are two primary classes of unequal-toned notes, that of the concords and that of the discords, and that of the concords is finer (*kallion*), so there are also two different primary classes of ratio between unequal numbers, one being that of what are called 'epimeric' or 'number

⁴⁰⁴ Düring suggested that this paragraph, including the statement by Thrasyllus, is also quoted from Aelianus, and the allusion to this writer in the next paragraph makes the hypothesis probable. I have therefore followed Düring in presenting it as a quotation. If that is correct the previous quotation from Thrasyllus (96.16–20) is also likely to have been embedded in Aelianus' discussion; and in that case he will be the source of the whole of 96.7–28, with the exception of the parenthesis at 96.10–12, which (as the allusion to Ptolemy shows) is clearly inserted by Porphyry himself.

⁴⁰⁵ That is, the fourth is conceived as lying at the bottom of the octave, with the fifth above it (*di' oxeiān* means 'through the higher <notes or strings>'). For the terms and explanations in this paragraph cf. Nicom. *Harm.* 252.4–14 Jan. I am not persuaded by Hagel's scepticism about the historical authenticity of the explanations; see Hagel (2009): 373 n. 22.

⁴⁰⁶ *Syllēpsis*, cognate with *syllabē*.

⁴⁰⁷ The sense is that in the basic position of the player's left hand (loosely analogous, perhaps, to 'first position' on a violin), the fingers spanned the lowest four strings on the instrument, whose compass was a perfect fourth.

⁴⁰⁸ The beginning of this statement is missing from the MSS. As Alexanderson notes, the supplement suggested by Düring (97.6–7) is unnecessarily elaborate. I have slightly modified one of his suggestions.

⁴⁰⁹ Since the matter discussed seems hardly to count as a 'discovery', it is tempting to replace *heurseōs*, 'discovery', with *haireseōs*, 'school', following a correction in one of the MSS. But that strategy is undermined by the fact that the immediate sequel is also devoted to Pythagorean ideas, explicitly referred to as those of the 'school' in the next sentence. If *heurseōs* needs to be emended, perhaps *chrēseōs*, 'usage' would be as good a candidate as any.

τὴν ἀπλότητα τῆς παραβολῆς, ὅτι μέρος ἐστὶν ἀπλοῦν ἐν αὐτῇ τῶν μὲν ἐπιμορίων ἢ ὑπεροχῇ, τῶν δὲ πολλαπλασίων τὸ ἔλαττον τοῦ μείζονος. ἐφαρμόσαντες δὴ διὰ τοῦτο τοὺς ἐπιμορίους καὶ πολλαπλασίους λόγους ταῖς συμφωνίαις, τὴν μὲν διὰ πασῶν προσάπτουσι τῷ διπλασίῳ λόγῳ, τὴν δὲ διὰ πέντε τῷ ἡμιολίῳ, τὴν δὲ διὰ τεσσάρων τῷ ἐπιτρίτῳ. λογι- [20] κώτερον μὲν ἐπιχειροῦντες, ἐπειδὴ τῶν τε συμφωνιῶν ἢ διὰ πασῶν ἐστὶ καλλίστη καὶ τῶν λόγων ὁ διπλάσιος ἄριστος, ἢ μὲν διὰ τὸ ἐγγυτάτω εἶναι τοῦ ἰσοτόνου, ὁ δὲ τῷ μόνος τὴν ὑπεροχὴν ἴσην ποιεῖν τῷ ὑπερεχο- μένῳ, καὶ ἔτι τὴν μὲν διὰ πασῶν συγκεῖσθαι συμβέβηκεν ἐκ δύο τῶν ἐφεξῆς καὶ πρώτων συμφωνιῶν, τῆς τε διὰ πέντε καὶ τῆς διὰ τεσσάρων, [25] τὸν δὲ διπλάσιον ἐκ δύο τῶν ἐφεξῆς καὶ πρώτων ἐπιμορίων, τοῦ τε ἡμιολίου καὶ τοῦ ἐπιτρίτου, μείζονα δὲ ἐνταῦθα μὲν τοῦ ἐπιτρίτου τὸν ἡμιόλιον λόγον, ἐκεῖ δὲ τῆς διὰ τεσσάρων τὴν διὰ πέντε συμφωνίαν, ὥστε καὶ τὴν ὑπεροχὴν αὐτῶν, τουτέστι τὸν τόνον, τίθεσθαι κατὰ τὸν [12] ἐπόγδοον λόγον, ὃ μείζων ἐστὶν ὁ ἡμιόλιος τοῦ ἐπιτρίτου, ἀκολουθῶς δὲ τούτοις καὶ τὸ μὲν ἐκ τῆς διὰ πασῶν καὶ τῆς διὰ πέντε συντιθέμενον μέγεθος καὶ ἔτι τὸ ἐκ δύο τῶν διὰ πασῶν, τουτέστι τὸ δις διὰ πασῶν, παραλαμβάνοντες εἰς τὰς συμφωνίας, ὅτι ταύτης μὲν ἀκολουθεῖ τὸν λόγον συνίστασθαι τετραπλάσιον, ἐκείνης δὲ τριπλάσιον, τὸ δ' ἐκ τῆς [5] διὰ πασῶν καὶ τῆς διὰ τεσσάρων οὐκέτι διὰ τὸ ποιεῖν λόγον τὸν τῶν ὁκτῶ πρὸς τὰ τρία, μήτε ἐπιμόριον ὄντα μήτε πολλαπλάσιον.

- (13) Καθάπερ τὴν στιγμὴν ἀρχὴν γραμμῆς εἶναι συμβέβηκεν, οὐ μὴν γραμ-
μὴν, οὕτω καὶ τὴν ἰσότητα ἀρχὴν διαστήματος θετέον, οὐ μὴν διάστημα.
- (15) καὶ τοῖνυν ἢ ἐν τοῖς φθόγγοις ὁμοφωνία ἀρχὴ μὲν τις ἐστὶ διαστήματος
ἐμμελοῦς, οὐ μὴν διάστημα. τὸ γὰρ διάστημα ἐν ἀνομοίοις φθόγγοις
κατὰ τάσιν θεωρεῖται, ἐπεὶπερ διαφορὰ τίς ἐστὶν ἀνομοίων φθόγγων τῇ
τάσει. διὸ ὥσπερ ἡ ἰσότης ἀδιαίρετός ἐστιν, οὕτω καὶ τὸ ἰσότονον οὐκ
ἔστι διελεῖν. διάστημα γὰρ οὐδέν, οὔτε τῶν ἰσοτόνων φθόγγων, οὔτε
- (20) τῶν ἴσων ἀριθμῶν εὐρίσκεται. πλειόνων γὰρ ἐξῆς ὁμοφώνων τιθεμέ-
νων καὶ ἡ περιοχὴ ὁμόφωνος ἀποτελεῖται. εἰκότως οὖν ταύτῃ ἀποδεδώ-
κασι τὴν ἰσότητα, ἐπειδὴ ἀπὸ τῆς ἰσότητος ἄρχεται πᾶς λόγος ὑφίστα-
σθαι τῶν ἀνίσων λόγων· ἐντεῦθεν γὰρ ἢ ἐπὶ τὸ ἀνισον τῆς νοήσεως ἢ
ἀνάβασις καὶ ἡ κατάληψις πάλιν ἐπὶ ταύτῃ, τῷ τὴν ἐν τοῖς ἀνίσοις λόγοις
- (25) διαφορὰν στάσιν μὴ ἐπιδέχεσθαι, εἰ μὴ εἰς τὴν ἰσότητα πέσῃ, ἀπὸ δὲ
τῶν ἰσοτόνων φθόγγων ἢ ἐπὶ τοὺς ἀνισοτόνους κατὰ τὴν ἐπίνοιαν γί-
νεται. παραβέβληται τὸ ἰσότονον τῶν λόγων τῇ ἰσότητι· ἀκολουθῶς

19 διάστημα A διάγραμμα g^{V187} 21 περιοχῇ] ὑπεροχῇ Wallis et Düring 23 ἀνίσων|
ἀνιστόνων p 26 ἰσοτόνων Alexanderson ἀνισοτόνων codd.

in lemmate: 12.5 τὸν δ' ἐκ p

to number' ratios, the other being that of the epimorics and multiples; and of these the latter is better (*ameinon*) than the former on account of the simplicity of the comparison, since in it the excess is a simple part in the case of the epimorics, while in the multiples the smaller term is a simple part of the greater. For this reason they fit the epimoric and multiple ratios to the concords, linking the octave to double ratio [2:1], the fifth to hemiolic [3:2] and the fourth to epitritic [4:3].

Their procedure here is very rational, since the octave is the finest of the concords and the double is the best of the ratios, the former because it is nearest to the equal toned, the latter because it alone makes the excess equal to that which is exceeded; and again, because the octave consists of the first two concords taken successively, and the double consists of the first two epimorics taken successively, the hemiolic and the epitritic; and while in the latter case the hemiolic ratio is greater than the epitritic, in the former the concord of a fifth is greater than that of a fourth, so that the excess of the one over the other – that is, the tone – is assigned to the epogdoic ratio [9:8], by which the hemiolic is greater than the epitritic. In accordance with these points they also adopt among the concords the magnitude put together from the octave and the fifth, and again that put together from two octaves – that is, the double octave – since it follows that the ratio of the latter amounts to the quadruple [4:1] and that of the former is triple [3:1]. But they do not adopt the magnitude put together from the octave and the fourth, because it makes the ratio of 8 to 3, which is neither epimoric nor multiple. Ptol. *Harm.* 11.8–12.7

Just as the point is the origin [*archē*] of the line, but is not a line, so equality is to be identified as the origin of the interval, but is not an interval. | So too in the case of notes the unison is the origin of the melodic interval, but is not an interval. For the interval is found in notes that are unlike in pitch, since it is a difference in pitch between unlike notes. Then just as equality is indivisible, so equality of tone cannot be divided. For no interval is found either between equal-toned notes or | between equal numbers, since when several notes in unison are placed in succession, that which bounds them is also made a unison.⁴¹⁰ They therefore naturally assigned equality to it, since every ratio among the ratios of unequals has its origin in equality. For it is from there that the understanding ascends to inequality, and to it that it descends again, since the difference between ratios of unequals | has no stopping-point unless it arrives at equality, and it is from equal-toned notes that the conceptual ascent to the unequal-toned notes takes place. The equal-toned has been treated as corresponding to the ratio of equality,

⁴¹⁰ I follow the MSS in reading *periōchē*, 'that which bounds them' or 'the compass', at 97.21. Düring adopts Wallis' emendation *hyperochē*, 'the excess'. But in a sequence of notes in unison the 'excess' (if any sense can be made of that expression) is zero, not a unison.

δὲ καὶ τὸ ἀνισότονον τοῖς ἐξῆς λόγοις παραβληθήσεται. ἐπεὶ οὖν τῶν ἐξῆς μετὰ τὴν ἰσότητα λόγων οἱ μὲν ἦσαν πολλαπλάσιοι, οἱ δ' ἐπιμόριοι, (30) οἱ δ' ἐπιμερεῖς, ἀκόλουθον ἦν ἐπισκέπτεσθαι, τίνες τε λόγοι μετὰ τὴν

(98) ἰσότητα κρείττους καὶ τίνες οἱ χείρους, εἴθ' οὕτω παραβαλεῖν τοὺς μὲν κρείττους τοῖς κρείττοσι, τοὺς δὲ χείρους τοῖς χείροσι.

Τῶν οὖν ἀνίσων λόγων οἱ μὲν πολλαπλάσιοι καὶ οἱ ἐπιμόριοι κρείττους τῶν ἐπιμερῶν, τῶν δ' ἀνισοτόνων κρείττους οἱ ἐμμελεῖς καὶ οἱ (5) σύμφωνοι τῶν ἀσυμφώνων. ἐφαρμοστέον ἄρα τοὺς ἐπιμορίους καὶ πολλαπλασίους λόγους τοῖς συμφώνοις, τοὺς δ' ἐπιμερεῖς τοῖς ἀσυμφώνοις. εἰσὶ δὲ κρείττους οἱ πολλαπλάσιοι καὶ ἐπιμόριοι τῶν ἐπιμερῶν, ἐπεὶ οὖν ἀπλουστέρα ἢ ἐν αὐτοῖς παραβολὴ τῆς τῶν ἐπιμερῶν κατὰ τοὺς ὅρους παραβολῆς. ἢ γὰρ τῶν πολλαπλασίων καὶ ἐπιμορίων παραβολὴ μέρος (10) ἔχει ἀπλοῦν ἐν αὐτῇ τῶν μὲν πολλαπλασίων <τόν> ἐλάσσονα ὅρων ἐχόντων τοῦ μείζονος, τῶν δ' ἐπιμορίων τὴν ὑπεροχὴν τοῦ μείζονος ὅρου μίαν κεκτημένων· ἐπὶ δὲ τῶν ἐπιμερῶν, ὅτι οὐκ ἦν τις ἀπλότης, ἀλλὰ μορίων πλει-

30 ἐπιμερεῖς G p.c. ἐκμελεῖς p ἐμμελεῖς V¹⁸⁷

10 <τόν> add. Alexanderson

and consequently the unequal-toned will be treated as corresponding to the ratios that follow. Then since some of the ratios that follow after equality are multiple, some epimoric | and some epimeric, the next task is to investigate which ratios after equality are superior and which are inferior, and then to make the superior correspond to the superior <intervals> and the inferior to the inferior.⁴¹¹

[98D]

Among the unequal ratios the multiple and the epimoric are superior to the epimeric, and among unequal-toned notes the melodic and the | concordant are superior to the non-concordant.⁴¹² Then the epimoric and multiple ratios must be attached to the concords, and the epimerics to the non-concordant <intervals>.⁴¹³ The multiples and epimerics are superior to the epimerics because the relation⁴¹⁴ between their terms is simpler than that between the terms of epimerics. For the relation in the case of multiples and epimerics | includes in itself a simple part; multiples have the smaller term as a simple part of the greater, and epimerics have 1 as the excess of the greater term <over the smaller>;⁴¹⁵ whereas we have seen that in the epimerics there is no simplicity, but the relation involves an

⁴¹¹ Porphry fails to preserve Ptolemy's distinction between *kalliōn*, 'finer' (or 'more beautiful') and *ameinōn*, 'better'. In the passage under discussion Ptolemy consistently applies the former term only to the concords and the latter only to the ratios. Here and in the immediate sequel Porphry uses the term *kreittōn* for both kinds of case. In the context there is little or no difference between the meaning of *kreittōn* and that of Ptolemy's *ameinōn*, but I have translated *kreittōn* as 'superior' rather than 'better' in order to preserve the shift in terminology.

⁴¹² Something is wrong here. The 'melodic' (*emmeles*) cannot be superior to the non-concordant. Ptolemy and Porphry sometimes use *emmeles* of musically acceptable relations in general, but where they draw a distinction between the melodic and the concordant, melodic intervals are those which are smaller than any of the concords. Hence all of them are non-concordant. The problem could most easily be eliminated by deleting the words 'the melodic and' from the text.

⁴¹³ Here Porphry uses the term *asymphōnos*, 'non-concordant', in place of Ptolemy's *diaphōnos*, 'discordant', which is much the more common expression. Porphry seems to imply that no non-concordant intervals can have an epimoric or a multiple ratio, but this is misleading. All relevant writers agree in assigning epimoric ratios to certain non-concordant intervals (e.g. the ratio 9:8 for the whole tone), and Ptolemy insists that all the 'melodic' intervals (i.e. simple scalar intervals) must have such ratios, though none of them is a concord (see in the first instance *Harm.* 12.26–7). Intervals that cannot occur in scales are usually designated as *ekmeleis*, 'unmelodic'. But Porphry can hardly have intended to refer to unmelodic intervals here. As a usage of the word *asymphōnos* it is linguistically and contextually improbable, and I suspect that he has been a little careless in this final comment.

⁴¹⁴ In my translation of Ptolemy I have represented the noun used here, *parabolē*, as 'comparison'. Either translation is legitimate; the noun can refer either to a relation between two items or to the act of comparing them by reference to such a relation; cf. n. 359 above. In Porphry's text 'relation' is more natural English, and I think it is likely to convey the sense he intended.

⁴¹⁵ Literally, 'epimerics have one excess of the greater term'. Porphry probably does not mean merely that the difference is always 1 when the ratio is expressed in its lowest terms, but that it is one simple part of each term; cf. the following note.

όνων ὑπεροχῆς παραβολή.

- (15) Λοιπὸν δὲ διὰ τί τῇ μὲν διὰ πασῶν ἐφαρμοστέον τῶν πολλαπλασίων τὸν διπλάσιον λόγον, τῇ δὲ διὰ τεσσάρων τῶν ἐπιμορίων τὸν ἐπίτριτον, τῇ δὲ διὰ πέντε τὸν ἡμιόλιον, εἴρηται σαφῶς παρὰ τῷ Πτολεμαίῳ.
 <γραμμικώτερον δὲ προσάγοντες εἰς ταύτῃ οὕτωςί πως. ἔστω γάρ φασι διὰ πέντε τὸ ΑΒ καὶ τούτῳ ἐφεξῆς ἕτερον διὰ πέντε τὸ ΒΓ, ὥστε τὸ ΑΓ εἶναι δις διὰ πέντε. καὶ ἐπεὶ ἀσύμφωνον τὸ δις διὰ πέντε, [10] οὐκ ἄρα πολλαπλάσιον τὸ ΑΓ, ὥστε οὐδὲ τὸ ΑΒ πολλαπλάσιον, σύμφωνον δέ, ἐπιμόριον ἄρα τὸ διὰ πέντε. κατὰ τὰ αὐτὰ δὲ καὶ τὸ διὰ τεσσάρων δείκνυσιν ἐπιμόριον ἔλαττον ὅν τοῦ διὰ πέντε. πάλιν ἔστω φασὶ διὰ

	θ'		δ'
Α	-----	Α	-----
	ιβ'		η'
Β	-----	Β	-----
	ις'		ις'
Γ	-----	Γ	-----

πασῶν τὸ ΑΒ καὶ τούτῳ ἐφεξῆς ἕτερον διὰ πασῶν τὸ ΒΓ, ὥστε τὸ ΑΓ γίνεσθαι δις διὰ πασῶν. ἐπεὶ τοίνυν σύμφωνόν ἐστι τὸ δις διὰ πασῶν, [15] τὸ ΑΓ ἄρα ἤτοι ἐπιμόριον ἐστίν ἢ πολλαπλάσιον, ἀλλ' οὐκ ἔστιν ἐπιμόριον—οὐ γάρ ἂν τις μέσος ἀνάλογον ἐνέπιπτεν—πολλαπλάσιον ἄρα τὸ ΑΓ, ὥστε καὶ τὸ ΑΒ πολλαπλάσιον, τὸ ἄρα διὰ πασῶν πολλαπλάσιον. πρόχειρον δὲ αὐτοῖς ἐκ τούτων, ὅτι καὶ τὸ μὲν διὰ πασῶν διπλάσιον, ἐκείνων δὲ τὸ μὲν διὰ πέντε ἡμιόλιον, τὸ δὲ διὰ τεσσάρων ἐπίτριτον. ἐπεὶ μόνος τῶν πολλαπλασίων ὁ διπλάσιος λόγος ὑπὸ δύο ἐπιμορίων σύγκειται τῶν μεγίστων, ὥστε τοὺς ἐξ ἄλλων ἐπιμορίων δύο συν-

13 ὑπεροχῆς παραβολή Düring περιοχῆς περιβολή codd.

in lemmate: 12.11 πολλαπλάσιον^{prim.}] διπλάσιον Düring cod. m secutus
 lemma a Düring ad 98.33 suppletum ad 98.17 transposui.

excess consisting of several parts.⁴¹⁶ As to the rest, Ptolemy explains clearly why one should assign the double ratio from among the multiples | to the octave, and the epitritie and the hemiolic from among the epimorics to the fourth and the fifth respectively.

<They argue to the same conclusion in a more geometrical way, roughly as follows. Let AB, they say, be a fifth, and let BC be another fifth, continuous with the first, so that AC is a double fifth. Since the double fifth is non-concordant, it follows that AC is not multiple,⁴¹⁷ and hence that AB is not multiple either. But it is concordant, and hence the fifth is epimoric. They show in the same way that the fourth, which is smaller than the fifth, is also epimoric.⁴¹⁸

A-----9
B-----12
C-----16

Again, they say, let AB be an octave, and let BC be another octave, continuous with the first, so that AC is a double octave. Then since

A-----4
B-----8
C-----16

the double octave is concordant, it follows that AC is either epimoric or multiple; but it is not epimoric, since if it were no mean would fall inside it proportionately, and hence AC is multiple. Hence AB too is multiple, and therefore the octave is multiple.⁴¹⁹ These conclusions show them that the octave is double, and that among the others, the fifth is hemiolic and the fourth is epitritie, since among the multiples, only the double ratio is a compound of two epimorics; for since these are the largest epimorics, ratios

⁴¹⁶ The text of this sentence is in some doubt, but the gist must be as I have translated it. The substance of Porphyry's remarks about epimorics and epimerics is this. When an epimoric ratio is expressed in its lowest terms the difference between the terms is always 1; hence whether it is expressed in its lowest terms or not, the difference is always a unit fraction or integral factor of both terms. In an epimeric ratio, by contrast, the difference is never an integral factor of the terms; in the ratio 5:3, for instance, it amounts to two of the 'parts' into which each is divisible, i.e. two fifths of the greater term and two thirds of the smaller.

⁴¹⁷ That is, the ratio A:C is not a multiple ratio. Here (12.11) I read *pollaplasion* with some MSS where Düring follows another MS in reading *diplasion* ('double'). The reasoning is that of *Sect. can.* prop. 11, which unlike that of the other propositions is logically flawed (it would be even more obviously so if we ignored the passage of *Sect. can.* and adopted Düring's reading). The principle established in the introduction to the *Sect. can.* is that every concord must have either a multiple or an epimoric ratio; but the reasoning here depends on the unsubstantiated (and indeed false) premise that every multiple ratio is the ratio of a concord.

⁴¹⁸ The first diagram that follows represents a sequence of two fourths, the second a sequence of two octaves. In the MSS the two appear side by side; I have separated them here for the sake of clarity.

⁴¹⁹ See *Sect. can.* prop. 10.

τιθεμένους λόγους ἐλάττονας συνίστασθαι τοῦ διπλασίου, μηδενὸς ἐλάττονος ὄντος πολλαπλασίου τοῦ διπλασίου, καὶ τοῦ τόνου δὲ ἀκολουθῶς ἐπογδόου δειχθέντος, ἀποφαίνουσι τὸ ἡμιτόνιον ἐκμελές, ἐπεὶ μηδ' [25] ἄλλος τις πάλιν ἐπιμόριος μέσος ἀνάλογον διαιρεῖται, δέον δὲ ἐν λόγοις ἐπιμορίοις εἶναι τὰ ἐμμελῆ.>

τὰ

δ' ἐξαρχῆς ἄχρι τοῦ τέλους τοῦ κεφαλαίου σαφηνίσομεν ἡμεῖς ἐκθέμενοι γραμμικὰ θεωρήματα πρὸς τὰς ἀποδείξεις αὐτῶν συντείνοντα, κείμενα δ' ἐν Τῇ τοῦ κανόνος Εὐκλείδου κατατομῇ, διὰ τὸ κατ'

- (20) ἐπιδρομὴν εἰρηκέναι τὸν Πτολεμαῖον τὰ τῶν Πυθαγορείων, ὧν αἱ προτάσεις εἰσὶν αἵδε.

Τὸ διὰ πέντε διάστημα ἐν ἐπιμορίῳ λόγῳ ἐστὶ καὶ τὸ διὰ τεσσάρων. τὸ διὰ πασῶν διάστημα ἐν πολλαπλασίῳ λόγῳ ἐστὶ· τὸ διὰ πασῶν διάστημα διπλασίον ἐστι, τὸ διὰ πέντε διάστημα ἡμιόλιον ἐστὶ καὶ τὸ διὰ

- (25) τεσσάρων ἐπίτριτον. τὸ διπλασίον διάστημα σύγκειται ἐκ δύο μεγίστων ἐπιμορίων· οὐδεὶς πολλαπλάσιος σύγκειται ἐξ ἐπιμορίων δύο λόγων,

compounded from two of the other epimorics are smaller than the double ratio, and there is no multiple smaller than the double.⁴²⁰ Since the tone is accordingly shown to be epogdoic, they demonstrate that the half-tone is unmelodic, since no other ratio which is itself epimoric can divide it [the ratio of the tone] proportionately in the middle, and melodic intervals must be in epimoric ratios.⁴²¹ > Ptol. *Harm.* 12.8–27⁴²²

We shall now elucidate the contents of the whole chapter from beginning to end, by setting down geometrical theorems which bear upon their [i.e. the Pythagoreans'] proofs, and which are presented in Euclid's *Section of the Canon*, since Ptolemy spoke | only cursorily about the views of the Pythagoreans.⁴²³ Their propositions are as follows.⁴²⁴

The intervals of the fifth and the fourth are in epimoric ratio [*Sect. can.* prop. 11]. The interval of the octave is in multiple ratio [prop. 10]. The interval of the octave is double, the interval of the fifth is hemiolic, and the | fourth is epitritus [prop. 12]. The double interval is composed from the two greatest epimorics [prop. 6]; and no multiple ratio is composed from two epimorics, with the single exception of the double [prop. 6a].⁴²⁵ The

⁴²⁰ See *Sect. can.* prop. 12.

⁴²¹ See *Sect. can.* props. 3 and 16. My translation of this difficult sentence follows that of Raffa (2002); it seems to be the only way of making sense of the Greek. But the argument in *Sect. can.* prop. 3 shows that there is no mean proportional whatever between the terms of an epimoric ratio, not merely that there is no mean that divides it into two other epimorics; and *Sect. can.* does not subscribe to Ptolemy's principle that melodic intervals must have epimoric ratios. I suspect that the text of Ptolemy's last sentence is corrupt. For further discussion see Raffa (2002): 300–2.

⁴²² This lemma, amounting to the whole of the remainder of Ptolemy's chapter, does not appear in the MSS. Since up to this point Porphyry's citations omit no sections of Ptolemy's text, it seems likely that he included it, especially in view of his next remark, that what follows will serve to elucidate the entire chapter. I include it in any case for the sake of completeness, and to provide readers with the whole passage that Porphyry has in mind. Düring inserted it a little later, at 98.33, but it fits awkwardly in that position, disrupting the continuity between Porphyry's statement that the proofs in the *Sect. can.* are 'as follows' and his actual quotation of them. The location I have given it may not be ideal, but I can find no better place to put it. Ptolemy has borrowed the arguments from [Eucl.] *Sect. can.* without acknowledgement, and without offering proofs of various propositions (demonstrated earlier in the *Sect. can.*) on whose truth these arguments depend.

⁴²³ It can hardly be maintained that Ptolemy spoke 'only cursorily' about the Pythagoreans. Porphyry probably means only that he dealt with the arguments of the *Sect. can.* in a summary way, which is true. Porphyry evidently treats the *Sect. can.* as a Pythagorean text; so too by implication does Ptolemy, given his inclusion of several of its propositions in this chapter on Pythagorean tenets. Most of the propositions which it collects and systematises may indeed have been drawn from Pythagorean sources, but there is no indication that the writer himself (who may not have been Euclid) had any doctrinal attachment to Pythagoreanism.

⁴²⁴ The paragraph that follows lists the conclusions of propositions 10–13 and 16 in the *Sect. can.*, as indicated by the numbers in the translation; it also includes a few fragments of the proofs. The order in which they are listed does not correspond exactly either to that in which they appear in the *Sect. can.* itself or to that in which Ptolemy alludes to them.

⁴²⁵ In the MSS of the *Sect. can.* this thesis appears explicitly only as part of the proof of prop. 12, where it is said, correctly, to follow from prop. 6. In Porphyry's version it is proved separately in prop. 6a; see 100.26–101.8 with n. 441 ad loc.

- εἰ μὴ μόνος ὁ διπλάσιος. ὁ τόνος ἐν ἐπογδῶ λόγῳ ἐστίν· ὁ τόνος οὐ διαιρεῖται εἰς δύο ἴσα, ὥστε ἡμιτόνιον οὐκ ἔσται. ἐπιμορίου διαστήματος οὐδεὶς μέσος ἀνάλογος ἐμπίπτει ἀριθμός. τὸ διὰ πασῶν καὶ διὰ πέντε τριπλάσιόν ἐστι, τὸ δὲ δις διὰ πασῶν τετραπλάσιον. αἱ δ' ἀποδείξεις αὐτῶν ἔχουσιν ὧδε.
- (99) “ἐὰν διάστημα πολλαπλάσιον δις συντεθὲν ποιῇ τι διάστημα, καὶ αὐτὸ πολλαπλάσιον ἔσται. ἔστω τι διάστημα τὸ ΒΓ καὶ ἔστω πολλαπλάσιος ὁ Β τοῦ Γ, καὶ γεγενῆσθω ὡς ὁ Γ πρὸς τὸν Β ὁ Β πρὸς τὸν Δ. φημί δὴ καὶ τὸν Δ πρὸς τὸν Γ πολλαπλάσιον εἶναι. ἐπεὶ γὰρ ὁ Β
- (5) τοῦ Γ πολλαπλάσιός ἐστι, μετρεῖ ἄρα ὁ Γ τὸν Β. ἦν δ' ὡς ὁ Γ πρὸς τὸν Β, ὁ Β πρὸς τὸν Δ, ὥστε μετρεῖ καὶ ὁ Γ τὸν Δ. πολλαπλάσιος ἄρα ἐστὶ καὶ ὁ Δ τοῦ Γ.
- ἐὰν διάστημα δις συντεθὲν τὸ ὅλον ποιῇ πολλαπλάσιον, καὶ αὐτὸ πολλαπλάσιον ἔσται. ἔστω διάστημα τὸ ΒΓ καὶ γεγενῆσθω ὡς ὁ Γ πρὸς
- (10) τὸν Β, οὕτω καὶ ὁ Β πρὸς τὸν Δ, καὶ ἔστω ὁ Δ τοῦ Γ πολλαπλάσιος. φημί καὶ τὸν Β τοῦ Γ πολλαπλάσιον εἶναι. ἐπεὶ γὰρ ὁ Δ τοῦ Γ πολλαπλάσιός ἐστι, μετρεῖ ἄρα ὁ Γ τὸν Δ. ἐμάθομεν δ' ἄρα ὅτι, ἐὰν ὧσιν ἀριθμοὶ ἀνάλογον ὅποσοιοῦν, ὁ δὲ πρῶτος τὸν ἔσχατον μετρήῃ, καὶ τοὺς μεταξὺ μετρήσει. μετρεῖ ἄρα ὁ Γ τὸν Β, πολλαπλάσιος ἄρα ὁ Β τοῦ Γ.
- (15) ἐπιμορίου διαστήματος μέσος, οὔτε εἰς οὔτε πλείους ἀνάλογον ἐμπεσεῖται ἀριθμός. ἔστω γὰρ ἐπιμόριον διάστημα τὸ ΒΓ· ἐλάχιστοι δ' ἐν τῷ αὐτῷ λόγῳ τοῖς ΒΓ ἔστωσαν ὁ ΔΖ καὶ ὁ Θ. οὗτοι οὖν ὑπὸ μονάδος μόνης μετροῦνται κοινοῦ μέτρου. ἀφείλον ἴσον τῷ Θ τὸν ΖΕ καὶ ἐπεὶ ἐπιμόριος ὁ ΔΖ τοῦ Θ, ἡ ὑπεροχὴ ἡ ΔΕ κοινὸν μέτρον τοῦ ΔΖ καὶ
- (20) τοῦ Θ· μονὰς ἄρα ἡ ΔΕ. οὐκ ἄρα ἐμπεσεῖται εἰς τοὺς ΔΖ Θ μέσος οὐδεὶς. ἔσται γὰρ ὁ ἐμπίπτων τοῦ μὲν ΔΖ ἐλάττων, τοῦ δὲ Θ μείζων,

apparatum pleniorē in textum [Eucl.] *Sect. can.* ap. Porph. 99.1–103.25 traditum habet Barbera (1991): 188–224

2 τι om. Eucl. 2–3 πολλαπλάσιος ὁ] πολλαπλάσιον τό codd. Eucl. 4 καὶ om. Eucl. πρὸς τὸν Γ] τοῦ Γ Eucl. 5 ante ὡς add. καὶ Eucl. 7 καὶ om. Eucl. 9 ἔσται πολλαπλάσιον Eucl. 10 καὶ^{prim.} om. Eucl. 11 εἶναι πολλαπλάσιον Eucl. 12 ἄρα^{sec.} om. Eucl. 15 ante μέσος add. οὐδεὶς Eucl. μέσος GV¹⁸⁷ μέσοι p 16 ΒΓ] Β τοῦ Γ codd. Eucl. 17 καὶ ὁ om. Eucl. 18 ἀφῆλε Eucl. ΖΕ] ΗΖ Eucl. 19 ante ὁ add. ἐστίν Eucl. ἡ ΔΕ] ὁ ΔΗ Eucl. τοῦ τε ΔΖ Eucl. 20 post Θ add. ἐστὶ Eucl. ἡ ΔΕ] ὁ ΔΗ Eucl. 21 μὲν om. Eucl.

tone is in epogdoic ratio [prop. 13]. The tone is not divisible into two equal intervals, and so there is no half-tone [prop. 16]. No mean proportional number falls within an epimoric ratio [prop. 3].⁴²⁶ The ratio of the octave plus a fifth | is triple, and the double octave is quadruple [remainder of prop. 12]. The proofs of these propositions are as follows.⁴²⁷

1. If a multiple interval put together twice makes some interval, that interval too will be multiple.⁴²⁸ [99D]

Let there be an interval BC and let B be a multiple of C, and let B be to D as C is to B. I say then that D is a multiple of C. For since B | is a multiple of C, it follows that C measures B.⁴²⁹ But B was to D as C was to B, so that C measures D too. Therefore D is a multiple of C.

2. If an interval put together twice makes a whole that is multiple, that interval itself will also be multiple.

Let there be an interval BC, let B be to D as C is to | B, and let D be a multiple of C. I say that B is also a multiple of C. For since D is a multiple of C, it follows that C measures D. But we have learned that if there are numbers in proportion, however many they may be, and if the first measures the last, it will also measure those in between.⁴³⁰ Therefore C measures B, and hence B is a multiple of C.

3. | No number, neither one nor several, will fall as a mean proportional in an epimoric ratio.⁴³¹

Let BC be an epimoric interval, and let DE and F be the smallest numbers in the same ratio as B is to C. The only common measure by which these are measured is therefore the unit. I took away⁴³² GE, which is equal to F.

⁴²⁶ The important conclusion of prop. 3 is essential to the proof of prop. 16.

⁴²⁷ Porphyry now quotes the first 16 of the 20 propositions in the *Sect. can.*, which I have numbered accordingly; each begins with a statement of what is to be proved, and the proof follows. Propositions 17–20 in the *Sect. can.* have no bearing either on Ptolemy's text or on the issues that Porphyry is discussing, and I take it that this is why Porphyry omits them. The text in Porphyry differs in many minor respects from the MS tradition of the *Sect. can.*; variants are noted below only where they significantly affect the sense. I have kept other footnotes on this passage to a bare minimum; for fuller commentary see Barbera (1991), Barker (2007): 364–410, Creese (2010): 22–36, 151–77.

⁴²⁸ In almost all the theorems, these propositions refer to 'intervals' (*diastēmata*) where we would expect 'ratios' (*logoi*), as Porphyry has pointed out at 92.29–93.4 above. Thus an expression such as 'the interval BC' can be read as meaning 'the ratio B:C'. From prop. 10 onwards, where specifically musical concepts are introduced, 'interval' continues to be used in place of 'ratio', but is used also to refer to the musical intervals themselves. In these cases an 'interval' can therefore be described as concordant or discordant, for example, as well as being described as multiple, epimoric and the like.

⁴²⁹ That is, C is a unit in terms of which the size of B can be measured; $B = nC$, where n is a whole number.

⁴³⁰ This is proved at Eucl. *El.* VII.7.

⁴³¹ A proof of this crucial proposition is credited to Archytas at Boeth. *Inst. mus.* III.11.

⁴³² The MSS of the *Sect. can.* have the imperative, 'Take away'. GE is to be subtracted from DE.

ὥστε τὴν μονάδα διαιρεῖσθαι, ὅπερ ἀδύνατον. οὐκ ἄρα ἐμπεσεῖται εἰς τοὺς ΔΖ Θ οὐδεῖς τις. ὅσοι δ' εἰς τοὺς ἐλαχίστους <μέσοι> ἀνάλογον ἐμπίπτουσι, τοσοῦτοι καὶ εἰς τοὺς τὸν αὐτὸν λόγον ἔχοντας ἀνάλογον

(25) ἐμπεσοῦνται. οὐδεῖς δ' εἰς τοὺς ΔΖ Θ ἐμπεσεῖται, ὥστε οὐδ' εἰς τοὺς ΒΓ ἐμπεσεῖται.

- (100) ἐάν διάστημα μὴ πολλαπλάσιον δις συντεθῇ, τὸ ὅλον οὔτε πολλαπλάσιον ἔσται, οὐτ' ἐπιμόριον. ἔστω γὰρ διάστημα μὴ πολλαπλάσιον τὸ ΒΓ, καὶ γεγενήσθω ὡς ὁ Γ πρὸς τὸν Β ὁ Β πρὸς τὸν Δ. λέγω ὅτι ὁ Δ τοῦ Γ οὔτε πολλαπλάσιος, οὐτ' ἐπιμόριός ἐστιν. ἔστω γὰρ πρῶτον ὁ Δ τοῦ Γ πολλαπλάσιος. οὐκοῦν ἐμάθομεν, ὅτι ἐάν διάστημα δις συντεθῇ τὸ ὅλον ποιῇ πολλαπλάσιον, καὶ αὐτὸ ἐστὶ πολλαπλάσιον. ἔσται ἄρα ὁ Β τοῦ Γ πολλαπλάσιος· οὐκ ἦν δέ· ἀδύνατον ἄρα τὸν Δ τοῦ Γ εἶναι πολλαπλάσιον. ἀλλὰ μὴν οὐδ' ἐπιμόριον. ἐπιμορίου γὰρ διαστήματος μέσος οὐδεὶς ἀνάλογον ἐμπίπτει· εἰς δὲ τοὺς ΔΓ ἐμπίπτει ὁ Β· ἀδύνατον ἄρα τὸν Δ τοῦ Γ ἢ πολλαπλάσιον ἢ ἐπιμόριον εἶναι· ὅπερ ἔδει δεῖξαι.

- ἐάν διάστημα δις συντεθῇ τὸ ὅλον μὴ ποιῇ πολλαπλάσιον, οὐδ' αὐτὸ ἐστὶ πολλαπλάσιον. ἔστω γὰρ διάστημά τι τὸ ΒΓ, καὶ γεγενήσθω ὡς ὁ Γ πρὸς τὸν Β ὁ Β πρὸς τὸν Δ, καὶ μὴ ἔστω ὁ Δ τοῦ Γ πολλαπλάσιος. λέγω ὅτι οὐδὲ ὁ Β τοῦ Γ πολλαπλάσιος ἔσται. εἰ γὰρ ἦ πολλαπλάσιος, ἔσται ὁ Δ τοῦ Γ πολλαπλάσιος· οὐκ ἔστι δέ. οὐκ ἄρα ὁ Β τοῦ Γ ἔσται πολλαπλάσιος.
- (15)

- τὸ διπλάσιον διάστημα ἐκ δύο τῶν μεγίστων ἐπιμορίων συνέστηκεν, ἕκ τε τοῦ ἡμιολίου καὶ ἐκ τοῦ ἐπίτριτου. ἔστω γὰρ ὁ μὲν Α τοῦ Β ἡμιόλιος, ὁ δὲ Β τοῦ Γ ἐπίτριτος. λέγω ὅτι ὁ Α τοῦ Γ ἐστὶ διπλάσιος. ἐπεὶ γὰρ ἡμιόλιός ἐστιν ὁ Α τοῦ Β, ὁ ἄρα Α ἔχει τὸν Β καὶ τὸν ἡμισυν αὐτοῦ. δύο ἄρα οἱ Α ἴσοι εἰσὶ τρισὶ τοῖς Β. πάλιν ἐπεὶ ὁ Β τοῦ Γ ἐστὶ ἐπίτριτος, ὁ ἄρα Β ἔχει τὸν Γ καὶ τὸ τρίτον αὐτοῦ. τρεῖς ἄρα οἱ Β εἰσὶν ἴσοι τέτταρσι τοῖς Γ. ὁ ἄρα Α ἴσος ἐστὶ δυσὶ τοῖς Γ· διπλάσιος
- (25) ἄρα ἐστὶν ὁ Α τοῦ Γ.

οὐδεὶς πολλαπλάσιος σύγκειται ἐξ ἐπιμορίων λόγων, εἰ μὴ μόνος ὁ διπλάσιος. εἰ γὰρ δυνατόν, ἄλλος πολλαπλάσιος λόγος ὁ ΑΓ συγκείσθω ἐκ δύο ἐπιμορίων λόγων τοῦ τε ΑΒ καὶ τοῦ ΒΓ· καὶ ἔστω ὁ μὲν Δ τοῦ

- (101) Ε ἡμιόλιος, ὁ δὲ Ε τοῦ Ζ ἐπίτριτος, διπλάσιος ἄρ' ἐστὶν ὁ Δ τοῦ Ζ.

23 οὐδεῖς om. Eucl. <μέσοι> add. Eucl. 24 τὸν om. p 25 ἐμπεσεῖται p ὥστε om. Eucl. τοὺς| τὸν p

4 ὅτι Eucl. οὕτως codd. 6 πολλαπλάσιον ἐστιν Eucl. 10 τὸν Δ τοῦ Γ Eucl. τὸν ΒΓ codd. 11–12 ὅπερ ἔδει δεῖξαι om. Eucl. 13 ἐστὶ| ἔσται Eucl. 15 ἔσται πολλαπλάσιος Eucl. ἢ πολλαπλάσιος| ἐστὶν ὁ Β τοῦ Γ πολλαπλάσιος Eucl. 16 ante ὁ Δ add. ἄρα Eucl. οὐκ ἔστι δέ om. p 23 ὁ Β ἄρα Eucl. οἱ Β ἴσοι Eucl. 24 ἄρα ὁ Α Eucl.

1 διπλάσιος G p.c. τριπλάσιος ceteri

Since DE is an epimoric of F,⁴³³ the excess⁴³⁴ DG is a common measure of DE and | F. DG is therefore a unit. Therefore no mean will fall between DE and F. For the intervening number will be smaller than DE and greater than F, and the unit will thus be divided, which is impossible. Therefore no mean will fall between DE and F. And however many mean proportionals fall between the smallest numbers, the same number will fall between any others which have | the same ratio.⁴³⁵ But none will fall between DE and F, and so none will fall between B and C.

4. If an interval which is not multiple is put together twice, the whole will be [100D]
neither multiple nor epimoric.

Let BC be an interval which is not multiple, and let B be to D as C is to B. I say that D is neither a multiple nor an epimoric of C. Suppose first | that D is a multiple of C. Now we have learned that if an interval put together twice makes a whole that is multiple, that interval too is multiple.⁴³⁶ Then B will be a multiple of C; but it was not. It is therefore impossible for D to be a multiple of C. But nor can it be an epimoric <of C>; for no mean proportional falls within an epimoric interval, whereas B falls <as a mean proportional> within | DC. It is therefore impossible for D to be either a multiple or an epimoric of C; and that is what was to be proved.⁴³⁷

5. If an interval put together twice does not make a whole that is multiple, that interval itself will not be multiple.

Let BC be an interval, let B be to D as C is to B, and let D not be a multiple of C. | I say that B will not be a multiple of C either. For if it is a multiple, D will be a multiple of C.⁴³⁸ But it is not. Therefore B will not be a multiple of C.

6. The double interval is composed of the two greatest epimoric intervals, the hemiolic and the epitritric.

Let A be the hemiolic | of B, and let B be the epitritric of C.⁴³⁹ I say that A is double C. For since A is the hemiolic of B, A contains B plus half of B. Hence two A's are equal to three B's. Again, since B is the epitritric of C, B contains C plus a third of C. Three B's are therefore equal to four C's. Hence A is equal to two C's, | and A is therefore double C.⁴⁴⁰

6a.⁴⁴¹ No multiple ratio except the double is composed of epimoric ratios.

If it is possible, let some other multiple ratio A:C be composed of two epimoric ratios, A:B and B:C. Let D be the hemiolic of E and let E be the [101D]

⁴³³ I.e. the ratio DE:F is epimoric. ⁴³⁴ I.e. the amount by which DE exceeds GE.

⁴³⁵ Proved at Eucl. *El.* VIII.8. ⁴³⁶ Shown in prop. 2.

⁴³⁷ The final 'QED' is not in the MSS of the *Sect. can.*

⁴³⁸ This follows from prop. 1. ⁴³⁹ I.e. A:B = 3:2, B:C = 4:3.

⁴⁴⁰ This is the second of two proofs of prop. 6 given in the MSS of the *Sect. can.* Like most of the other propositions it is couched in arithmetical terms; the first, omitted by Porphyry and probably absent from his copy, is geometrical.

⁴⁴¹ This proposition is not in the MSS of the *Sect. can.* I give it the label 6a merely for convenience. Its questionable authenticity is underlined by its use of the term 'ratio' where the other propositions use 'interval'; cf. n. 428 above. For an explanation of the reasoning see Barbera (1991): 209 n. 17.

καὶ ἐπεὶ τῶν ἐπιμορίων λόγος μέγιστός ἐστιν ὁ ἡμιόλιος, δεύτερος δ' ὁ ἐπίτριτος, εἷς τῶν ΔΕ ΕΖ λόγων ἐνὶ τῶν ΑΒ ΒΓ ἤτοι ὁ αὐτός ἐστιν ἢ ὁ ἕτερος τοῦ ἐτέρου ἢ ἀμφοτέρω ἀμφοτέρων μείζονες· ὅπως δ' ἂν ἔχη,

(5) ὁ Δ πρὸς τὸν Ζ μείζονα λόγον ἔχει ἥπερ ὁ Α πρὸς τὸν Γ· ὅπερ ἀδύνατον. τῶν γὰρ πολλαπλασίων λόγων ἐλάχιστός ἐστιν ὁ διπλάσιος. οὐδεις ἄρα λόγος πολλαπλάσιος σύγκειται ἐκ δύο ἐπιμορίων λόγων, εἰ μὴ μόνος ὁ διπλάσιος.

- (10) ἐκ τοῦ διπλασίου διαστήματος καὶ ἡμιολίου τριπλάσιον διάστημα γίνεται. ἔστω γὰρ ὁ μὲν Α τοῦ Β διπλάσιος, ὁ δὲ Β τοῦ Γ ἡμιόλιος. λέγω, ὅτι ὁ Α τοῦ Γ ἐστὶ τριπλάσιος. ἐπεὶ γὰρ ὁ Α τοῦ Β ἐστὶ διπλάσιος, ὁ Α ἄρα ἴσος ἐστὶ δυσὶ τοῖς Β. πάλιν ἐπεὶ ὁ Β τοῦ Γ ἐστὶν ἡμιόλιος, ὁ ἄρα Β ἔχει τὸν Γ καὶ τὸν ἥμισυν αὐτοῦ. δύο ἄρα οἱ Β ἴσοι εἰσὶ τρισὶ τοῖς Γ· δύο δ' οἱ Β ἴσοι εἰσὶ τῷ Α· καὶ ὁ Α < ἄρα ἴσος ἐστὶ τρισὶ τοῖς Γ· τριπλάσιος ἄρα ἐστὶν ὁ Α > τοῦ Γ.

- (15) ἐὰν ἀπὸ ἡμιολίου διαστήματος ἐπίτριτον διάστημα ἀφαιρεθῇ, τὸ λοιπὸν καταλείπεται ἐπόγδοον. ἔστω γὰρ ὁ μὲν Α τοῦ Β ἡμιόλιος, ὁ δὲ Γ τοῦ Β ἐπίτριτος. λέγω ὅτι ὁ Α τοῦ Γ ἐστὶν ἐπόγδοος. ἐπεὶ γὰρ ὁ Α τοῦ Β ἐστὶν ἡμιόλιος, ὁ ἄρα Α ἔχει τὸν Β καὶ τὸ ἥμισυν αὐτοῦ. ὁκτώ
- (20) ἄρα οἱ Α ἴσοι εἰσὶ δώδεκα τοῖς Β. πάλιν ἐπεὶ ὁ Γ τοῦ Β ἐστὶν ἐπίτριτος, ὁ ἄρα Γ ἔχει τὸν Β καὶ τὸ τρίτον αὐτοῦ. ἐννέα ἄρα οἱ Γ ἴσοι εἰσὶ δώδεκα τοῖς Β· δώδεκα δ' οἱ Β ἴσοι εἰσὶν ὁκτώ τοῖς Α· ὁκτώ ἄρα οἱ Α ἴσοι εἰσὶν ἐννέα τοῖς Γ. ὁ ἄρα Α ἴσος ἐστὶ τῷ Γ καὶ τῷ ὀγδόῳ αὐτοῦ, ὁ ἄρα Α τοῦ Γ ἐστὶν ἐπόγδοος.

- (25) τὰ ἕξ ἐπόγδοα διαστήματα μείζονά ἐστι διαστήματος ἐνὸς διπλασίου. ἔστω γὰρ τις ἀριθμὸς ὁ Α· καὶ τοῦ μὲν Α ἐπόγδοος ἔστω ὁ Β, τοῦ δὲ Β ἐπόγδοος ὁ Γ, τοῦ δὲ Γ ἐπόγδοος ὁ Δ, τοῦ δὲ Δ ἐπόγδοος ὁ Ε, τοῦ δὲ Ε ἐπόγδοος ὁ Ζ, τοῦ δὲ Ζ ἐπόγδοος ὁ Η. λέγω, ὅτι ὁ Η τοῦ Α μείζων ἐστὶν ἢ διπλάσιος. ἐπεὶ ἐμάθομεν εὐρεῖν ἐπτὰ ἀριθμούς ἐπογδόους ἀλλήλων,
- (30) εὐρήσθωσαν οἱ ΑΒΓΔΕΖΗ, καὶ γίνεται ὁ μὲν Α μυριάδες κς', βρμδ'

- (102) ὁ δὲ Β μυριάδες κθ', δ'λιβ'
 ὁ δὲ Γ μυριάδες λγ', αψος'
 ὁ δὲ Δ μυριάδες λζ', γσμη'
 ὁ δὲ Ε μυριάδες μα', θ'λδ'
 (5) ὁ δὲ Ζ μυριάδες μζ', βτβ'
 ὁ δὲ Η μυριάδες νγ', αυμα'

13 ἄρα ὁ Β ἔχει Eucl. 14 < ἄρα — 15 ὁ Α > add. Eucl. 17 γάρ om. G 19 ὁ Α ἄρα Eucl.
 21 ὁ Γ ἄρα Eucl. 25 διαστήματος Eucl. διαστήματα codd. 26 τις] εἷς Eucl. 28 Α] Δ g
 29 ἐπεὶ ἐμάθομεν εὐρεῖν ἐπτὰ Eucl. ἐμάθομεν δ' ἐπτά Porph. ἐπογδόους ἀλλήλων] ὁκτώ G ἀλλήλων]
 ἀλλ' ἢ p

4 Ε] Δ p 5 μζ' μυριάδες p 6 νγ' μυριάδες p v¹⁸⁷

epitritic of F. D is therefore double F. And since the hemiolic is the greatest of the epimorics and the second is the epitritic, either one of the ratios D:E and E:F is the same as one of the ratios A:B and B:C and the other is greater than the other, or else both of the former are greater than both of the latter. But whichever is the case, | the ratio D:F will be greater than the ratio A:C; and this is impossible, since the double is the smallest of the multiple ratios. Hence no multiple ratio except the double is composed of two epimoric ratios.

7. From a double and a hemiolic interval a triple interval | is produced.

Let A be double B, and let B be the hemiolic of C. I say that A is triple C. For since A is double B, A is equal to two B's. Again, since B is the hemiolic of C, B contains C plus half of C. Hence two B's are equal to three C's. But two B's are equal to A. Hence A is equal | to three C's, and therefore A is triple C.⁴⁴²

8. If an epitritic interval is subtracted from a hemiolic interval, the remainder left is epogdoic.

Let A be the hemiolic of B, and let C be the epitritic of B. I say that A is the epogdoic of C. For since A is the hemiolic of B, A contains B and a half of B. Then eight | A's are equal to twelve B's. Again, since C is the epitritic of B, C contains B and a third of B. Thus nine C's are equal to twelve B's. But twelve B's are equal to eight A's, and hence eight A's are equal to nine C's. A is therefore equal to C and an eighth of C, and hence A is the epogdoic of C.

9. | Six epogdoic intervals are greater than one double interval.

Let there be some number, A. Let B be the epogdoic of A, C the epogdoic of B, D the epogdoic of C, E the epogdoic of D, F the epogdoic of E, and G the epogdoic of F. I say that F is more than double A. Since we have learned how to find⁴⁴³ seven numbers which are one another's epogdoics, | let the numbers A, B, C, D, E, F and G have been found. A is 262,144; B is 294,912; C is 331,776; D is 373,248; E is 419, 904; | F is 472,392; G is 531,441; and G is more than double A.⁴⁴⁴

[102D]

10. The interval of the octave is multiple.

Let A be *nētē hyperbolaion*, let B be *mesē* and let C be *proslambanomenos*.⁴⁴⁵ Then since interval | AC is a double octave, it is concordant. It is therefore

⁴⁴² Most of this final sentence is missing from the MSS of Porphyry. I follow Düring in adding the remainder on the basis of the MSS of the *Sect. can.* For the procedure see Eucl. *El.* VII.2.

⁴⁴³ The words translated as 'since' and 'how to find' appear in the MSS of the *Sect. can.* They are not in the MSS of Porphyry, but something of the sort must be supplied to complete the syntax. For the procedure see Eucl. *El.* VII.2.

⁴⁴⁴ The first nine theorems have been purely arithmetical. In the remaining theorems the writer uses their conclusions as the basis for propositions about the ratios of musical intervals and their mathematical properties.

⁴⁴⁵ *Nētē hyperbolaion* is at the top of the two-octave system, *mesē* is an octave below it, and *proslambanomenos* is the lowest note of the system, an octave below *mesē*.

καὶ ἔστιν ὁ Η τοῦ Α μείζων ἢ διπλάσιος.

- (10) τὸ διὰ πασῶν διάστημα ἔστι πολλαπλάσιον. ἔστω γὰρ νήτη μὲν ὑπερβολαίων ὁ Α, μέση δ' ὁ Β, προσλαμβανόμενος δ' ὁ Γ. τὸ ἄρα ΑΓ διάστημα δις διὰ πασῶν ὄν, ἐστὶ σύμφωνον· ἦτοι οὖν ἐπιμόριόν ἐστιν ἢ πολλαπλάσιον. ἐπιμόριον μὲν οὖν οὐκ ἔστιν· ἐπιμορίου γὰρ διαστήματος μέσος οὐδεὶς ἀνάλογον ἐμπίπτει, πολλαπλάσιον ἄρ' ἐστίν. ἐπεὶ οὖν διαστήματα δύο τὰ ΑΒ ΒΓ συντεθέντα ποιεῖ πολλαπλάσιον τὸ ὅλον, καὶ τὸ ΑΒ ἄρα ἐστὶ πολλαπλάσιον.

- (15) τὸ διὰ τεσσάρων διάστημα καὶ τὸ διὰ πέντε ἐκάτερον ἐπιμόριον ἔστιν. ἔστω γὰρ νήτη μὲν συνημμένων ὁ Α, μέση δ' ὁ Β, ὑπάτη δ' ὁ Γ· τὸ ἄρα ΑΓ διάστημα δις διὰ τεσσάρων ἐστὶ διάφωνον· οὐκ ἄρα ἐστὶ πολλαπλάσιον. ἐπεὶ οὖν δύο διαστήματα ἴσα, τὰ ΑΒ ΒΓ, συντεθέντα μὴ ποιεῖ πολλαπλάσιον, <οὐδ' ἄρα τὸ ΑΒ ἐστὶ πολλαπλάσιον.> καὶ (20) ἔστι σύμφωνον· ἐπιμόριον ἄρα. ἢ αὐτὴ δ' ἀποδείξῃς καὶ ἐπὶ τοῦ διὰ πέντε.

- τὸ δὲ διὰ πασῶν διάστημα ἔστι διπλάσιον. οὐκοῦν ἦτοι διπλάσιόν ἐστιν ἢ μείζων ἢ διπλάσιον, ἀλλ' ἐπεὶ ἐδείξαμεν τὸ διπλάσιον διάστημα ἐκ δύο τῶν μεγίστων ἐπιμορίων συγκείμενον, ὥστ' εἴ ἐσται τὸ διὰ (25) πασῶν μείζων διπλασίου, οὐ συγκίεσται ἐκ δύο μόνων ἐπιμορίων, ἀλλ' ἐκ πλειόνων· σύγκειται δ' ἐκ δύο συμφώνων διαστημάτων, ἐκ τοῦ διὰ πέντε καὶ ἐκ τοῦ διὰ τεσσάρων· οὐκ ἄρ' ἔσται τὸ διὰ πασῶν μείζων τοῦ διπλασίου, διπλάσιον ἄρα.

- ἀλλ' ἐπειδὴ τὸ διὰ πασῶν ἐστὶ διπλάσιον, τὸ δὲ διπλάσιον ἐκ τῶν (30) μεγίστων ἐπιμορίων δύο συνέστηκε· συνέστηκε δ' ἐκ τοῦ διὰ πέντε καὶ ἐκ τοῦ διὰ τεσσάρων, ὄντων ἐπιμορίων· τὸ μὲν ἄρα διὰ πέντε, ἐπειδὴ (103) μείζον ἐστιν, ἡμιόλιον ἂν εἴη, τὸ δὲ διὰ τεσσάρων ἐπίτριτον.

φανερὸν δέ, ὅτι καὶ τὸ διὰ πέντε καὶ τὸ διὰ πασῶν τριπλάσιον· ἐδείξαμεν γάρ, ὅτι ἐκ διπλασίου διαστήματος καὶ ἡμιολίου τριπλάσιον διάστημα γίνεται· ὥστε τὸ διὰ πασῶν καὶ διὰ πέντε τριπλάσιον.”

13 διαστήματα Eucl. δύο (ἴσα add. Meibom) 16 μέση] μέσος GV⁸⁷ 19 <ουδ' – πολλαπλάσιον> add. Eucl. 20 ἐπιμορίων p 26 ἐκ τε τοῦ Eucl. 30 post συνέστηκε^{prim.} add. καὶ τὸ διὰ πασῶν ἄρα ἐξ ἡμιολίου καὶ ἐπίτρίτου συνέστηκε· ταῦτα γὰρ μέγιστα Eucl. δ'] γάρ codd. Eucl.

1 ἡμιόλιος g 2 post τριπλάσιον add. ἐστιν Eucl. 4–5 τριπλάσιον ἀποδεδείκται· εἰ ἄρα codd. τριπλάσιον ἐστιν· ἀποδεδείκται ἄρα ὅτι Eucl.

either epimoric or multiple.⁴⁴⁶ Now it is not epimoric, since there is no mean proportional in an epimoric ratio.⁴⁴⁷ Hence it is multiple. Then since the two intervals AB and BC put together make a whole which is multiple, AB is therefore multiple too.⁴⁴⁸

11. | The intervals of the fourth and the fifth are both epimoric.

Let A be *nētē synēmmenōn*, let B be *mesē* and let C be *hypatē*.⁴⁴⁹ Then since interval AC is a double fourth it is discordant. Hence it is not multiple.⁴⁵⁰ Then since when two equal intervals, AB and BC, are put together they make an interval which is not multiple, neither is AB multiple.⁴⁵¹ And | it is concordant; therefore it is epimoric. The same demonstration applies also to the fifth.

12. The interval of the octave is double.

It is either double or more than double;⁴⁵² but we have shown that the double interval is made up of the two greatest epimoric intervals,⁴⁵³ so that if the | octave is more than double it will not be made up of just two epimorics, but of more. But it is made up of two concordant intervals, the fifth and the fourth. Hence the octave will not be more than double, and hence it is double.

But since the octave is double, and the double is made up of the | two greatest epimorics, the octave is therefore made up of the hemiolic and the epitritie, since these are the greatest.⁴⁵⁴ But it is made up of the fifth and the fourth, these being epimoric. Then since the fifth is the greater, it must be hemiolic, and the fourth must be epitritie.

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It is clear that the octave plus a fifth is triple. For we have shown that a triple interval arises from a double plus a hemiolic interval.⁴⁵⁵ Hence the octave plus a fifth is triple.⁴⁵⁶

⁴⁴⁶ This follows from the reasoning attributed to the Pythagoreans at 98.3–13 above, but Porphyry has not quoted the passage of the *Sect. can.* which states the rule that the ratios of concords must be either multiple or epimoric. It comes at the end of the introduction to the treatise, part of which Porphyry has quoted at 90.7–23; but he (rather strangely) omits the relevant sentences.

⁴⁴⁷ See prop. 3 above. ⁴⁴⁸ See prop. 2.

⁴⁴⁹ *Nētē synēmmenōn* and *hypatē* (i.e. *hypatē mesōn*) are respectively a fourth above and a fourth below *mesē*.

⁴⁵⁰ Here the writer makes an uncharacteristic error. His principle is that all concords must have either multiple or epimoric ratios, not that all multiple ratios are ratios of concords. Only the latter thesis would justify the present reasoning, and no ancient author asserts it, for the good reason that it is false. The multiple ratio 5:1, for instance, is that of a double octave plus a major third, which by Greek standards is a discord; 7:1 is that of three octaves less a (rather large) whole tone. Though the conclusion of prop. 11 is true, it cannot be proved mathematically by any means at the writer's disposal; and this undermines the remaining theorems, since prop. 11's conclusion is essential to their proofs.

⁴⁵¹ The last clause ('neither is AB multiple') is missing from the MSS of Porphyry and must be supplied from those of the *Sect. can.* For the reasoning see prop. 5.

⁴⁵² This follows from prop. 10, which shows that the octave's ratio is multiple. ⁴⁵³ See prop. 6.

⁴⁵⁴ The words from 'the octave is therefore' to the end of the sentence are missing from Porphyry's text and are supplied from the MSS of the *Sect. can.*

⁴⁵⁵ See prop. 7. ⁴⁵⁶ The MSS of the *Sect. can.* add the statement: 'The double octave is quadruple'.

- (5) ἀποδέδεικται ἄρα τῶν συμφώνων ἕκαστον, ἐν τίσιν λόγοις ἔχει τοὺς περιέχοντας φθόγγους πρὸς ἀλλήλους.

λοιπὸν δὴ περὶ τοῦ τονιαίου διαστήματος διελθεῖν, ὅτι ἐστὶν ἐπόγδοον. ἐμάθομεν γάρ, ὅτι ἐὰν ἀπὸ ἡμιολίου διαστήματος ἐπίτритον διά-

- (10) στημα ἀφαιρεθῇ, τὸ λοιπὸν καταλείπεται ἐπόγδοον. ἐὰν δ' ἀπὸ τοῦ διὰ πέντε τὸ διὰ τεσσάρων ἀφαιρεθῇ, τὸ λοιπὸν τονιαῖόν ἐστι διάστημα· τὸ ἄρα τονιαῖον διάστημά ἐστιν ἐπόγδοον.

τὸ δὲ διὰ πασῶν ἔλαττον ἐστὶν ἢ ἕξ τόνων. δέδεικται γάρ τὸ μὲν διὰ πασῶν διπλάσιον, ὃ δὲ τόνος ἐπόγδος· τὰ δ' ἕξ ἐπόγδοα διαστήματα μείζονα διαστήματός ἐστι διπλασίου. τὸ ἄρα διὰ πασῶν ἔλαττον

- (15) ἢ ἕξ τόνων.

τὸ δὲ διὰ τεσσάρων ἔλαττον δύο τόνων καὶ ἡμιτονίου, καὶ τὸ διὰ πέντε ἔλαττον τριῶν τόνων καὶ ἡμιτονίου. ἔστω γάρ νήτη μὲν διεzeugμένων ὁ Β, παραμέση δὲ ὁ Γ, μέση δὲ ὁ Δ, ὑπάτη δὲ <μέσων> ὁ Ζ.

- (20) οὐκοῦν τὸ μὲν ΓΔ διάστημα τόνος, τὸ δὲ ΒΖ διὰ πασῶν ὃν ἔλαττον ἕξ τόνων. τὰ δὲ λοιπὰ ἄρα, τὸ τε ΒΓ καὶ τὸ ΔΖ ἴσα ὄντα ἔλαττον δύο τόνων καὶ ἡμιτονίου, ὃ ἐστι διὰ τεσσάρων· τὸ δὲ ΒΔ ἔλαττον τριῶν τόνων καὶ ἡμιτονίου, ὃ ἐστι διὰ πέντε.

ὁ τόνος οὐ διαιρεθήσεται εἰς δύο ἴσα οὔτε εἰς πλείω. ἐδείχθη γὰρ ὦν ἐπιμόριος· ἐπιμορίου δὲ διαστήματος <μέσοι> οὔτε πλείους οὔτε

- (25) εἰς ἀνάλογον ἐμπίπτουσιν. οὐκ ἄρα διαιρεθήσεται εἰς ἴσα.”

8 ἀπό] τὸ V¹⁸⁷ 11 ἄρα Eucl. γὰρ codd. Porph. 12 δέ om. Eucl. ἐστὶν om. Eucl.
14 διαστήματος Eucl. διαστήματα codd. ἐστὶ] εἰς g ἔλαττον om. sed lacuna in textu V¹⁸⁷ 15 ἢ]
ἐστὶν Eucl. 16 δέ om. Eucl. 18 μέση] μέσος pV¹⁸⁷ <μέσων> add. Eucl. 19 post τόνος
add. ἐστὶν Eucl. 20 post ἴσα ὄντα verba ἐλάττονά ἐστι πέντε τόνων. ὥστε τὸ ἐν τῷ ΒΓ in
Eucl. reperiantur 23 ἴσα Jan ἴσους codd. πλείω] πλείους Eucl. 24 <μέσοι> add. Eucl.
25 ante εἰς add. ὁ τόνος Eucl.

| We have therefore demonstrated, for each of the concords, the ratios in which their bounding notes stand to one another.⁴⁵⁷

13. The remaining task is to consider the interval of a tone, showing that it is epogdoic.⁴⁵⁸

We have learned that if an epitritus interval is subtracted from a hemiolic interval, the remainder which is left is epogdoic;⁴⁵⁹ and if a | fourth is subtracted from a fifth, the remainder is the interval of a tone. Thus⁴⁶⁰ the interval of a tone is epogdoic.

14. The octave is less than six tones.⁴⁶¹

It has been shown that the octave is double and the tone is epogdoic. Six epogdoic intervals are greater than the double interval.⁴⁶² Therefore the octave is less | than six tones.

15. The fourth is less than two and a half tones, and the fifth is less than three and a half tones.

Let B be *nētē diezeugmenōn*, let C be *paramesē*, let D be *mesē* and let E be *hypatē*.⁴⁶³ Then interval CD is a tone, and the octave BE is less than six | tones. Then each of the remainders, BC and DE, which are equal, is less than two and a half tones; and this is a fourth;⁴⁶⁴ and BD, which is a fifth, is less than three and a half tones.

16. The tone will not be divided into two or more equal intervals.

It has been shown to be epimoric. But no mean proportional, neither one nor more than | one, falls within an epimoric interval.⁴⁶⁵ Hence it will not be divided into equal intervals.

⁴⁵⁷ The writer does not mention the interval of an octave plus a fourth, which by normal Greek standards (including Ptolemy's) is a concord, but whose ratio is neither multiple nor epimoric (it is 8:3). Porphyry discusses Ptolemy's treatment of the issue in the next chapter.

⁴⁵⁸ It is 'the remaining task' in the sense that the tone is the last and smallest of the intervals which the writer quantifies. The constructions discussed in last four propositions of the treatise (which Porphyry omits) involve implicit reference to smaller intervals (approximately half-tones and quarter-tones), but they are not explicitly mentioned and no ratios are assigned to them.

⁴⁵⁹ See prop. 8.

⁴⁶⁰ Here I follow the MSS of the *Sect. can.*; instead of 'thus' the MSS of Porphyry read 'for', which is plainly inappropriate.

⁴⁶¹ This proposition and the next two challenge assumptions made by exponents of empirical harmonics, and specifically by Aristoxenus.

⁴⁶² See prop. 9.

⁴⁶³ *Nētē diezeugmenōn* is a fourth above *paramesē*; *paramesē* is a tone above *mesē*; *mesē* is a fourth above *hypatē mesōn*. (The MSS of the *Sect. can.* include the word *mesōn* qualifying *hypatē*.) Thus *nētē diezeugmenōn* is an octave above *hypatē*.

⁴⁶⁴ The MSS of the *Sect. can.* read: 'Then the remainders, BC and DE, which are equal, are less than five tones. Hence the interval in BC, which is a fourth, is less than two and a half tones.' But Porphyry's briefer version still gives a valid proof.

⁴⁶⁵ See prop. 3.

Δέδεικται μὲν οὖν καὶ ἐκάστη τῶν προκειμένων προτάσεων. ἀρξώ-
μεθα δὲ καὶ τοῦ ἐξῆς κεφαλαίου σαφηνίζοντες τὴν τοῦ Πτολεμαίου φω-

- (104) νὴν ἀνατρέπειν βουλομένου τὴν αἵρεσιν τῶν Πυθαγορείων. τὸ δὲ κε-
φάλαιόν ἐστι τοῦτο.

5

[13] Τοιαύτης δὴ τυγχανούσης τῆς περὶ τὰς συμφωνίας τῶν Πυθαγο-
ρείων ὑποθέσεως ἡ διὰ πασῶν καὶ διὰ τεσσάρων συμφωνία παντάπασιν
ἐναργῆς οὕσα δυσωπεῖ τὸν ἐφηρμοσμένον ὑπ' αὐτῶν λόγον. καθόλου
γὰρ ἡ διὰ πασῶν συμφωνία, τῶν ποιούντων αὐτὴν φθόγγων ἀδιαφορούν-
των κατὰ τὴν δύναμιν ἑνός, ὅταν προσαφθῇ τινι τῶν ἄλλων, ἀπαρά- [5]
τρεπτον τὸ ἐκείνης εἶδος τηρεῖ, καθάπερ ἡ δεκάς ἔχει, φέρε εἰπεῖν, πρὸς
τούς ὑπ' αὐτὴν ἀριθμούς. κἂν ληφθῇ τις ἐπὶ τὰ αὐτὰ τοῖς ἄκροις τοῦ
διὰ πασῶν, οἷον ἐπὶ τὸ βαρύτερον ἀμφοτέρων ἢ πάλιν ἐπὶ τὸ ὀξύτερον,
ὥς ἂν ἔχη πρὸς τὸν ἐγγύτερον αὐτῶν, οὕτως ἔχειν φαίνεται καὶ πρὸς τὸν
ἀπώτερον, καὶ τὴν αὐτὴν ἐκείνῳ δύναμιν ἔχει. ἄδονται δὲ αἱ μὲν διὰ [10]
πέντε καὶ διὰ τεσσάρων συμφωνίαι καθ' αὐτάς ἐν τῇ πρὸς τὸν ἐγγύτερον
τοῦ διὰ πασῶν σχέσει, ἡ δὲ διὰ τεσσάρων μετὰ τῆς διὰ πασῶν καὶ
πάλιν ἡ διὰ πέντε μετὰ τῆς διὰ πασῶν ἐν τῇ πρὸς τὸν ἀπώτερον, ὥστε
εἰκότως τὴν αὐτὴν ἀντίληψιν γίνεσθαι ταῖς ἀκοαῖς τῆς μὲν διὰ τεσσάρων
καὶ διὰ πασῶν τῇ μόνῃ τῆς διὰ τεσσάρων, τῆς δὲ διὰ πέντε καὶ διὰ [15]
πασῶν ἀντίληψιν τῇ μόνῃ τῆς διὰ πέντε, καὶ διὰ τοῦτο πάντως ἐξακο-
λουθεῖν τῷ μὲν τὸ διὰ πέντε σύμφωνον εἶναι καὶ τὸ διὰ πασῶν καὶ διὰ
πέντε σύμφωνον εἶναι, τῷ δὲ τὸ διὰ τεσσάρων σύμφωνον εἶναι καὶ τὸ
διὰ πασῶν καὶ διὰ τεσσάρων σύμφωνον εἶναι, καὶ τὸν αὐτὸν γε τρόπον
ἔχειν τὴν τοῦ διὰ πέντε καὶ διὰ πασῶν ἀντίληψιν πρὸς τὴν τοῦ διὰ [20]
τεσσάρων καὶ διὰ πασῶν, ὅνπερ ἡ μόνου τοῦ διὰ πέντε πρὸς τὴν μόνου
τοῦ διὰ τεσσάρων ἀκολουθῶς τοῖς ἀπὸ τῆς ἐναργοῦς πείρας καταλαμ-
βανομένοις.

- (5) "Ὁ λέγει τοιοῦτόν ἐστιν. οἱ ποιοῦντες τὴν διὰ πασῶν συμφωνίαν φθόγ-
γοι, οἷον ὑπάτη μέσων καὶ νήτη διεzeugμένων, ἀδιαφοροῦσι κατὰ τὴν
δύναμιν ἑνός φθόγγου· ὄντων γὰρ ἐναντίων δυνάμεις ἐστὶν ἡ αὐτὴ καὶ
οὕτως γ' ἀμφοῖν ὡς ἑνός. τοῦτο γὰρ ἐστὶ τὸ δύο ἀδιαφορεῖν ἑνός κατὰ
δύναμιν, ὅταν ἐκ δυεῖν ἀποδέδωται δυνάμεις ὥσπερ ἀπὸ τοῦ ἑνός. διὸ
(10) καὶ ἀντίφωνοι οἱ φθόγγοι λέγονται, ὡς ἀντίθεος ὁ ἰσόθεος καὶ ἀντιάνει-
ραι αἱ ἀμάζονες αἱ τῇ δυνάμει ἀνδράσιν ἰσούμεναι καίτοι οὐσαι γυναι-

Each of the propositions we set out previously⁴⁶⁶ has thus been demonstrated. Let us now begin on the next chapter, clarifying Ptolemy's language when he is trying to refute the Pythagorean school (*hairesis*). The chapter [104D] is as follows.

Chapter 6

This being the Pythagoreans' postulate about the concords, the fact that the octave plus a fourth is plainly a concord puts to shame the ratio they assign to it. For it is always the case that the concord of an octave, whose constituent notes do not differ in function from just one, always keeps the form of the latter unaltered when it is attached to any of the others, just as the number 10, for instance, does when added to numbers smaller than itself. And if any is constructed in the same direction from both extremes of the octave, downwards from both of them or again upwards, as it is to the nearer of them so it appears to be to the further, and it has the same function as that one. The concords of the fifth and the fourth are sung by themselves in relation to the nearer note of the octave, and the fourth together with the octave, and again the fifth together with the octave, in relation to the further. Hence it is to be expected that the same impression comes to the ears from the fourth plus an octave as there does from the fourth alone, and that the impression of the fifth plus an octave is the same as that of the fifth alone. Thus it clearly follows from the fact that the fifth is concordant that the octave plus a fifth is concordant too, and from the fact that the fourth is concordant that the octave plus a fourth is concordant too, and that the impression of the fifth plus an octave is related in the same way to that of the fourth plus an octave as is that of the fifth alone to that of the fourth alone; and this agrees with the results found through clear perceptual experiment. Ptol. *Harm.* 13.1–22

| What he is saying is something like this. The notes that make the concord of the octave, *hypatē mesōn* and *nētē diezeugmenōn*, for instance, do not differ in function (*dynamis*) from just one note; for although they are opposites their function is the same, and thus the function of both is as that of one. For this is what it is for two not to differ in function from just one: it is what happens when a function is expressed by two notes as if by one. This is why | the notes are also called *antiphōnoi*, just as someone equal to a god is called *antitheos*, and the Amazons, who are equal in strength (*dynamis*) to men although they are women, are called *antianeirai*.⁴⁶⁷ The

⁴⁶⁶ At 98.22–30.

⁴⁶⁷ Porphyry seems to be taking the prefix *anti* in the sense 'equivalent to'. In that case the heroic *antitheoi* are equivalent to gods, and the *antianeirai* Amazons are equivalent to men; and pairs of notes that are *antiphōnoi* are equivalent to a single *phōnē* (a vocal sound, and here evidently a pitched note). The adjective *antiphōnos* is indeed sometimes used of the octave, or of a note at the octave from some other; see e.g. [Aristotle] *Probl.* XIX.16–19 (918b–919a).

κες. ἔλεγον δ' οἱ περὶ τὸν Ἀρχύταν ἑνὸς φθόγγου γίνεσθαι κατὰ τὰς συμφωνίας τὴν ἀντίληψιν τῇ ἀκοῇ.

- Καὶ συνεχώρει τοῦτο καὶ Διονύσιος ἐπὶ <τοῖς> τῆς διὰ πασῶν κατὰ δύναμιν ἑνὸς φθόγγου ἀδιαφοροῦσιν, ὅταν ἄλλη τινὶ τῶν συμφωνιῶν προσληφθῶσιν, ὥς εἰς συνάπτεται. ὁποῖω γὰρ ἂν συναφθῇ τὸ σύμφωνον φθόγγω εἴτε τῇ νήτῃ, εἴτε τῇ ὑπάτῃ, ὥς ἐνὶ καὶ τῷ αὐτῷ συνάπτεται. διὸ καὶ ἀπαράτρεπτον τηρεῖ τὸ <τῆς> συναφθείσης συμφωνίας εἶδος, καὶ γίνεται τὸ συμβαῖνον οἶον ἐπὶ τῶν ἀριθμῶν. οἱ γὰρ ἐντὸς τῆς δεκάδος συντεθειμένοι μὲν ἀλλήλοις μεταβάλλουσι τὸ εἶδος, τῇ δεκάδι δὲ προσαφθέντες τηροῦσιν ἀπαράτρεπτον. δύο μὲν γὰρ καὶ τρία, πέντε· δύο δὲ καὶ δέκα, ὁμοίως δέκα καὶ δύο· καὶ εἰ πάλιν, μένει τὸ εἶδος [δεκάδος]· οὐ γὰρ παρ' ὅσον τῇ δεκάδι προστίθεται, ἐκβιβάζεται· παρ' ὅσον δ' ἄλλω τινι παρὰ τὴν δεκάδα· δεκάδος οὖν πάλιν προστεθείσης, ὅμοιον τῶν ἐντὸς τῆς δεκάδος μένει τὸ εἶδος· εἴκοσι γὰρ δύο, πάλιν τὰ αὐτά.
- Τὸν αὐτὸν οὖν τρόπον φησὶ τῇ διὰ πασῶν συμφωνίᾳ πεπονθέναι· ἐπεὶ γὰρ οἱ φθόγγοι οἱ ἀποτελοῦντες αὐτὴν ἀδιαφοροῦσιν ἑνὸς κατὰ δύναμιν,
- (105) καὶ ἔοικεν αὕτη ἡ συμφωνία δεκάδι, ὥσπερ καθ' αὐτὰς αἱ συμφωνίαι οὐ παρατρέπονται τοῦ οἰκείου εἶδους, οὕτως οὐδὲ σὺν τῇ διὰ πασῶν. ὅταν οὖν τῇ νήτῃ τῶν διεξευγμένων συναφθὲν τετράχορδον τὸ ὑπερβολαῖον, τὴν νήτην τῇ ὑπάτῃ ἔχῃ σύμφωνον, ἀδιαφόρων ἑνὸς ὄντων τῶν (5) δυεῖν φθόγγων τῆς διὰ πασῶν κατὰ δύναμιν, ἀδιαφόρως καὶ νήτῃ ὑπερβολαίων τούτοις συμφωνήσῃ· καὶ οὕτως ὥς ἐνὶ καὶ τῷ αὐτῷ φθόγγῳ

14 συγχωρεῖ G <τοῖς> τῆς Alexanderson τοῖς Düring τῆς codd. 16 συνάπτεται p
18 <τῆς> add. Düring συναπτουσης G συμφωνίας συναφθείσης V¹⁸⁷ 21 ἀπαράτρεπτον Düring
ἀδιάτρεπτον codd. 22 [δεκάδος] del. Alexanderson 24 ἄλλω τινὶ παρὰ Wallis ἄλλω τινὶ παντὶ
V¹⁸⁷ ἄλλω παντὶ τινὶ g

3 τῇ] τῶν pV¹⁸⁷ 4 ἀδιαφόρων Alexanderson ἀδιάφορον codd. 5 ὑπερβολαίων Düring ὑπερ-
βολαίου codd.

followers of Archytas said that in the concords, the impression the hearing receives is of just one note.⁴⁶⁸

Dionysius too agrees with this thesis about notes an octave apart, which | do not differ in function from just one note, that when they are added to any of the other concords, they are attached to it as if they were one note.⁴⁶⁹ For to whichever note the concord is attached, whether it is *nētē* or *hypatē*, it is attached as if to one and the same note. This is why it keeps the form of the attached concord unaltered; and what happens is like what happens with numbers. For when those within the decad⁴⁷⁰ | are added to one another they change their form, but when joined to the decad they keep it unaltered. Thus 2 plus 3 is 5, but 2 plus 10 is again 10-and-2;⁴⁷¹ and if this is done again, its form remains unchanged, for in so far as it is added to the decad it does not vary, though in so far as it is added to anything other than the decad, it does. Then when the decad is added again, | the form of the numbers within the decad is unchanged; for we get 20-and-2, the same again.

Ptolemy says that the same thing happens with the concord of the octave. For since the notes that produce it do not differ in function from one note, this concord seems to resemble the decad; just as the concords by themselves do not diverge from the form proper to them, neither do they when they are combined with the octave. Thus when the tetrachord *hyperbolaion*, which is conjoined with *nētē diezeugmenōn*, has this *nētē* in concord with *hypatē*, then since the two notes of the octave | do not differ in function from one note, *nētē hyperbolaion* too will be concordant with them both in the same way; and thus in its concordance as if with one and the same note, it will preserve its own

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⁴⁶⁸ Düring prints what Archytas' followers said as a direct quotation, but the syntax does not encourage this interpretation and it is more likely to be Porphyry's paraphrase. Comparable statements appear in many Greek texts, though they usually avoid the word 'note' in referring to the unified impression, either using a word meaning 'sound' instead or else omitting the noun altogether. What they assert is that when two notes in concord are played or sung simultaneously, each of them loses its individual identity in a unified blend of sound. Whatever may be true of the octave, it is implausible to claim that when the concord is a fifth or a fourth, for instance, this blend itself is heard as a note, that is, as a sound with a definite pitch which is different from those of the notes actually played.

⁴⁶⁹ On this Dionysius see 37.15 above.

⁴⁷⁰ The decad here is the number 10; those 'within' it are the numbers smaller than 10.

⁴⁷¹ Porphyry is apparently relying on the Greek way of naming the number 12, and every other number which is the sum of 10 or any of its multiples and a number smaller than 10; they always contain the name of the smaller number as a component. Greek arithmetical symbols for such numbers behave in a similar way.

- τηρήσει τε τὸ ἑαυτῆς εἶδος κατὰ τὴν συμφωνίαν· ἔάν τε πρὸς τὸν ἐγγύτερον τῶν συμφώνων φθόγγων συγκρουσθῇ, οἷον πρὸς τὴν νήτην τῶν διεzeugμένων, ἔάν τε πρὸς τὸν ἀπώτερον, οἷον ὑπάτην μέσων. τὸ μὲν
- (10) οὖν εἶδος ταῦτο τῆς συμφωνίας τηρηθήσεται. ἤδη δὲ τῷ ἐγγυτέρῳ συγκρουσθεῖσα τὴν καθ' ἑαυτὴν διὰ τεσσάρων συμφωνίαν ἀποδώσει· τῷ δὲ πορρωτέρῳ, οἷον ὑπάτην τὴν διὰ τεσσάρων καὶ διὰ πασῶν· καίπερ εἰ σύμφωνος καθ' ἑαυτὴν ἢ διὰ τεσσάρων, καὶ ἢ διὰ πασῶν καὶ διὰ τεσσάρων σύμφωνος. καὶ ἀνάλογον τῇ διὰ πέντε καὶ διὰ πασῶν.
- (15) θάπερ γὰρ ἢ διὰ πέντε καθ' ἑαυτὴν οὔσα σύμφωνος διαμένει ὁμοίως καὶ ὅταν τῇ διὰ πασῶν προσαφθῇ, οὕτως καὶ ἢ διὰ τεσσάρων ἔχουσα θεωρεῖται. διὸ καὶ ἢ ἀντίληψις τῷ ἀδιαφορεῖν τοὺς συμφώνους φθόγγους ἑνὸς τοὺς τῆς διὰ πασῶν τοιαύτη ταῖς ἀκοαῖς γίνεται τῆς διὰ τεσσάρων καὶ διὰ πασῶν, οἷα αὐτῆς καθ' ἑαυτὴν τῆς διὰ
- (20) τεσσάρων. οὐκοῦν καὶ εἰ σύμφωνον τὸ διὰ τεσσάρων, σύμφωνον ἂν εἴη καὶ τὸ διὰ πασῶν καὶ διὰ τεσσάρων. ἡ μὲν οὖν ἐξήγησις τῶν εἰρημένων τοιαύτη.

- Δεῖ δὲ προσυπακούειν τῶν εἰρημένων τοιαῦτα. τῷ μὲν οὖν οὕτω ῥηθέντι “καθόλου γὰρ ἢ διὰ πασῶν συμφωνία τῶν ποιούντων αὐτὴν
- (25) φθόγγων ἀδιαφορούντων κατὰ τὴν δύναμιν ἑνός” προσυπακούειν δεῖ τοῦ φθόγγου. ἀδιαφοροῦσι γὰρ οἱ ποιοῦντες τὴν διὰ πασῶν συμφωνίαν φθόγγου ἑνός. τῷ δ' οὕτω ῥηθέντι “ὅταν προσαφθῇ τινι” ἢ διὰ πασῶν συμφωνία. ὅταν γὰρ ἢ διὰ πασῶν συμφωνία προσαφθῇ τινι συμφωνία τῶν ἄλλων, ἀπαράτρεπτον τὸ ἐκείνης εἶδος τηρεῖ· ἐκείνης μὲν λέγει

9 οἷον Düring ὅσον V¹⁸⁷ ὅσην vel ὅς ἦν g ὑπάτην Düring ὑπάτη codd. 12 οἷον] ὅσην g
20 τεσσάρων scripsi πέντε codd. <τεσσάρων, καὶ ἢ τῆς διὰ πέντε καὶ διὰ πασῶν, οἷα αὐτῆς καθ' ἑαυτὴν τῆς διὰ> πέντε Düring 24 ποιούντων αὐτὴν G τοιοῦτων αὐτὴν V¹⁸⁷ τοιοῦτων αὐτῇ p
27–8 ἢ διὰ πασῶν συμφωνία scripsi τῇ διὰ πασῶν συμφωνία codd.

form.⁴⁷² Whether it is played together with the nearer of the concordant notes, that is, *nētē diezeugmenōn*, or with the more distant one, *hypoatē mesōn*, the | form of the concord will have been kept the same. When played together with the nearer note it will give out the concord of the fourth as it is by itself, and when played together with the more distant one, *hypoatē*, it will give out the octave plus a fourth – even though if the fourth by itself is concordant, so too is the octave plus a fourth.⁴⁷³ It is analogous to the octave plus a fifth. | For just as the fifth, which by itself is concordant, remains unchanged also when it is attached to the octave, so it is too with the fourth. Thus because the concordant notes of the octave do not differ from one note, the impression made on the hearing by the octave plus a fourth is of the same kind as that made by | the fourth by itself.⁴⁷⁴ Thus if the fourth is concordant, the octave plus a fourth must be concordant too. That, then, is the explanation of what Ptolemy has said.

The following things must be understood as implicit in Ptolemy's remarks. In the clause 'for it is always the case that the concord of an octave, whose constituent | notes do not differ in function from one',⁴⁷⁵ we must understand the word 'note'; for the notes that make the concord of an octave do not differ from one. In the phrase 'when it is attached to any . . . ' we must understand 'concord of the octave'.⁴⁷⁶ For when the octave is attached to any of the other concords, 'it keeps the form of the latter unaltered'.⁴⁷⁷ By 'the latter' he means | any random concord to which

⁴⁷² Porphyry evidently means that the concord between *nētē hyperbolaion* and *nētē diezeugmenōn*, a fourth, will keep the same form when an octave is added to it, creating the concord between *nētē hyperbolaion* and *hypoatē mesōn*. (On a strict construction of the Greek, he is saying that the note *nētē hyperbolaion* will keep its own form, which makes no sense in the context.) The tetrachord *hyperbolaion* is the highest in the system, 'conjoined' with *nētē diezeugmenōn*, in the sense that this latter note is both the lowest of the tetrachord *hyperbolaion* and the highest of the tetrachord *diezeugmenōn*. *Nētē hyperbolaion* is thus a fourth above *nētē diezeugmenōn*, which in turn is an octave above *hypoatē mesōn*.

⁴⁷³ Porphyry writes 'even though', because the conclusion that the octave plus a fourth is concordant flies in the face of the principle long ago adopted by Pythagoreans and other exponents of mathematical harmonics, that all concords must have either multiple or epimoric ratios. The whole argument is in fact designed to demonstrate that the Pythagoreans are wrong about this, by underwriting and clarifying Ptolemy's refutation of their position.

⁴⁷⁴ The MSS read 'fifth' instead of 'fourth' at the end of this sentence. Düring offers an elaborate supplement which preserves the word 'fifth'; I prefer merely to emend 'fifth' to 'fourth' on the assumption that the former is a copyist's error, and I have translated accordingly.

⁴⁷⁵ Ptol. *Harm.* 13.3–5.

⁴⁷⁶ Ptol. *Harm.* 13.5. As it stands in the MSS, the grammar of Porphyry's comment requires us to read his phrase as 'attached to any concord of the octave', and this is plainly wrong. The octave is the subject of Ptolemy's statement, and it ends with the phrase 'to any of the others'; its full sense is 'to any of the other concords'. The remainder of Porphyry's paragraph reflects Ptolemy's real meaning, and the error is probably that of a copyist, who mistakenly wrote 'concord of the octave' in the dative case instead of the nominative.

⁴⁷⁷ Ptol. *Harm.* 13.5–6.

- (30) τῆς τυχούσης συμφωνίας, ἥ προσάπτεται ἢ διὰ πασῶν· τηρεῖ δὲ τὸ εἶδος αὐτῆς ἀπαράτρεπτον ἢ διὰ πασῶν, οἷον ἔστω ἢ διὰ πέντε ἢ ἄλλη τις συμφωνία παρὰ τὴν διὰ πασῶν· ταύτη οὖν ἔαν ἢ διὰ πασῶν συναφθῇ, τηρεῖ τὸ εἶδος ἀπαράτρεπτον, ὁμοίως ὥσπερ ἐξ ἀρχῆς <ἦ> ἢ διὰ πέντε.
- (106) "Όταν δὲ λέγει "κἂν ληφθῇ τις ἐπὶ τὰ αὐτὰ τοῖς ἄκροις τοῦ διὰ πασῶν," τὸ "ἐπὶ τὰ αὐτὰ" δεῖ ἀκούειν, οἷον ἀμφοτέρων τῶν ἄκρων τοῦ διὰ πασῶν ἐπὶ τὸ βαρύτερον ἂν ληφθῇ τις συμφωνία ἢ ἀμφοτέρων ἐπὶ τὸ ὀξύτερον· οἷον τῆς διὰ πασῶν ἄκρων ὑπάτης <μέσων> καὶ νήτης διε-
 (5) ζευγμένων· ἐπὶ μὲν τὸ βαρύτερον τῶν ἄκρων ἐστὶ λαβεῖν σύμφωνον, οἷον τὸ διὰ τεσσάρων· τῆς μὲν νήτης ἐπὶ τὸ βαρύτερον τὸ τετράχορδον τὸ διεζευγμένων, οὗ συμφωνεῖ ἡ παραμέση τῇ νήτῃ διὰ τεσσάρων· τῆς δ' ὑπάτης ἐπὶ τὸ βαρύτερον τὸ ὑπάτων τετράχορδον, οὗ ἡ ὑπάτη ὑπάτων τῇ ὑπάτῃ μέσων συμφωνεῖ διὰ τεσσάρων· ἐπὶ δὲ τὸ ὀξύτερον τῶν
 (10) ἄκρων ἔαν λάβωμεν τὸ διὰ τεσσάρων, οἷον τῆς νήτης διεζευγμένων <ἐπὶ τὸ ὀξύτερον τὸ τετράχορδον τὸ ὑπερβολαίων, οὗ> ἢ νήτῃ ὑπερβολαίων τῇ νήτῃ διεζευγμένων συμφωνήσῃ διὰ τεσσάρων· τῆς δ' ὑπάτης μέσων ἐπὶ τὸ ὀξύτερον τὸ τετράχορδον τὸ [διά] μέσων, οὗ ἡ μέση συμφωνεῖ τῇ ὑπάτῃ μέσων διὰ τεσσάρων. ἔαν οὖν ἐπὶ τὰ αὐτὰ τοῖς ἄκροις τοῦ διὰ πασῶν
 (15) ληφθῇ τι σύμφωνον, ὥς ἂν ἔχη φησὶ τὸ ληφθὲν πρὸς τὸν ἐγγύτερον αὐτῶν τῶν ἄκρων τοῦ διὰ πασῶν, ἔξει τὸ ληφθὲν σύμφωνον καὶ πρὸς τὸν ἀπώτερον αὐτοῦ τῶν ἄκρων. οἷον τῆς διὰ πασῶν οὔσης συμφωνίας, ἥς οἱ ἄκροι ὑπάτη καὶ νήτη, εἰλήφθω ἐπὶ τὸ ὀξύτερον τῆς νήτης σύμφωνον τὸ διὰ τεσσάρων τοῦ ὑπερβολαίου συστήματος, ἢ τοίνυν νήτῃ ὑπερ-
 (20)βολαίων συμφωνεῖ τοῖς ἄκροις τοῦ διὰ πασῶν, ἃ ἦν ὑπάτη καὶ νήτη διεζευγμένων, <ὧν ὁ μὲν ἐγγύς ἢ νήτῃ,> ὁ δὲ πόρρω ἐστὶν ὅσον ἢ ὑπάτῃ. ὥς οὖν ἔχει πρὸς τὴν νήτην, οὕτως ἔχει καὶ πρὸς τὴν ὑπάτην. τοῦτ' οὖν συμβαίνει, διότι οἱ ἄκροι τοῦ διὰ πασῶν ἀδιαφοροῦσι κατὰ τὴν δύναμιν ἐνός· ὁμοίως δ' ἔχει, κἂν ἐπὶ τὸ βαρύτερον θάτερον, τουτέστιν εἰ
 (25) τῇ ὑπάτῃ προσαφθῇ τι σύμφωνον.
 Λοιπὸν δ' ἐξηγεῖται τὸ συμβαῖνον ἐν τῇ ἐπὶ τὸ ἐγγύτερον ἄκρον τοῦ διὰ πασῶν σχέσει τοῦ προσαφθέντος συμφώνου καὶ πάλιν τὸ συμβαῖνον

33 <ἦ> add. Düring ἢ] οἱ p

1 ἄκροις A ἄλλοις g^{V187} 2 τοῦ Alexanderson καὶ codd. 3 τις Düring τῇ g τῆς V¹⁸⁷ συμφωνίας V¹⁸⁷ 4 <μέσων> add. Düring 7 συμφωνεῖ Düring σύμφωνον codd. παραμέση A περὶ μέσων ceteri 10 <ἐπὶ — 11 οὗ> add. Wallis 13 ὀξύτερον Wallis ὀξύχορδον codd. [διά] del. Düring μέση Wallis μέσων codd. τῇ ὑπάτῃ Wallis τῆς ὑπάτης codd. 15 τῇ] τό g τόν] τό codd. 16 τόν] τό p 21 <ὧν — νήτῃ> add. Wallis ὅσον] ὅσον G 26 δ' om. G

the octave is attached; the octave keeps the form of it unaltered, whether it is the fifth or any other concord apart from the octave.⁴⁷⁸ Thus if the octave is added to this one [i.e. the fifth], it keeps the form unaltered, just as the fifth was originally.

When he says 'and if any is constructed in the same direction from both extremes of the octave',⁴⁷⁹ one must interpret 'in the same direction' so as to give the sense: 'if any concord is constructed in the direction of lower pitch from both extremes of the octave, or in the direction of higher pitch from both'. Suppose for instance that the extremes of the octave are *hypatē mesōn* and *nētē diezeugmenōn*. | In the direction of lower pitch from the extremes one can construct a concord, for instance a fourth – in the direction of lower pitch from the *nētē* the tetrachord *diezeugmenōn*, whose *paramesē*⁴⁸⁰ is concordant at the fourth with *nētē*, and in the direction of lower pitch from the *hypatē* the tetrachord *hypatōn*, whose *hypatē hypatōn* is concordant at the fourth with *hypatē mesōn*. We can also construct | a fourth in the direction of higher pitch from the extremes – in the direction of higher pitch from *nētē diezeugmenōn*, for instance, the tetrachord *hyperbolaion*, whose *nētē hyperbolaion* will be concordant at the fourth with *nētē diezeugmenōn*, and in the direction of higher pitch from *hypatē mesōn* the tetrachord *mesōn*, whose *mesē* is concordant at the fourth with *hypatē mesōn*. He says, therefore, that if anything concordant is constructed in the same direction | from both extremes of the octave, as the item constructed is to the nearer of these extremes of the octave, so it will be to the extreme that is more distant from it. Thus given the concord of an octave whose extremes are *hypatē* and *nētē*, let there be constructed in the direction of higher pitch from *nētē* the concord of the fourth of the system *hyperbolaion*.⁴⁸¹ *Nētē hyperbolaion* | is concordant with the extremes of the octave, *hypatē* and *nētē diezeugmenōn*, of which the nearer is *nētē*⁴⁸² and the more distant is *hypatē*. Then as it is to the *nētē*, so it is also to the *hypatē*. This comes about because the extremes of the octave do not differ in function from one. And the same holds also if the other one lies on the lower side, that is, if | some concord is attached to *hypatē*.

Ptolemy next explains what arises in the relation of the attached concord to the nearer extreme, and again what arises in its relation to the more

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⁴⁷⁸ The proposition will still be true even if the concord to which the octave is attached is itself an octave. But the phrase on which Porphyry is commenting specifies 'any of the others'.

⁴⁷⁹ Ptol. *Harm.* 13.7–8.

⁴⁸⁰ The lowest note of the tetrachord *diezeugmenōn*, a fourth below its *nētē*.

⁴⁸¹ That is, the tetrachord *hyperbolaion*.

⁴⁸² The words 'of which the nearer is *nētē*' are not in the MSS; the supplement was suggested by Wallis.

- ἐν τῇ πρὸς τὸν ἀπώτερον ἄκρον τοῦ διὰ πασῶν σχέσει. αἱ μὲν γὰρ καθ' αὐτάς καὶ ἀπλαῖ συμφωνίαι γίνονται, οἷον διὰ πέντε ἢ διὰ τεσσάρων, ἐν
- (30) τῇ πρὸς τὸν ἐγγύτερον τοῦ διὰ πασῶν σχέσει, αἱ δὲ σύνθετοι καὶ μετὰ τῆς διὰ πασῶν λαμβανόμεναι, οἷον διὰ πέντε καὶ διὰ πασῶν ἢ διὰ τεσ-
- (107) σάρων καὶ διὰ πασῶν ἐν τῇ πρὸς τὸν ἀπώτερον ἄκρον τοῦ διὰ πασῶν σχέσει. τὰ δὲ λοιπά, ὅσα ἐκ τούτων συλλογίζεται, σαφῆ εἰς τὰ προειρημένα καθέστηκε. ταῦτα μὲν οὖν ἠπόρηται πρὸς τοὺς Πυθαγορείους ἀπὸ τῶν τῇ αἰσθήσει ὑποπιπτόντων ἐκ τῆς διὰ πασῶν καὶ διὰ τεσσάρων
- (5) συμφωνίας. λογικὰς δὲ πρὸς αὐτοὺς ἐπάγων ζητήσεις, γράφει ταῦτα.

**ἐμποιεῖ δ' αὐτοῖς οὐ τὴν τυχοῦσαν ἀπορίαν καὶ τὸ μόνους
τούτοις τῶν ἐπιμορίων καὶ πολλαπλασίων προσάπτειν τὰς συμφωνίας,
τοῖς δ' ἄλλοις μηκέτι—λέγω δὲ οἷον ἐπιτετάρτοις καὶ τοῖς πενταπλα- [25]
[14] σίοις ἐνὸς εἵδους ὄντος αὐτοῖς πρὸς ἐκείνους—**

- (7) Διὰ τί γὰρ ἐπὶ τῶν ἐπιμορίων λόγων μόνους τοῖς ἐπιτρίτοις καὶ ἡμιολίοις ἐν ταῖς συμφωνίαις κέχρηται, ἐπὶ δὲ τῶν πολλαπλασίων τῷ διπλασίῳ καὶ τριπλασίῳ μόνους, οὐκέτι δὲ τοῖς λοιποῖς τῶν ἐπιμορίων ἢ τοῖς
- (10) λοιποῖς τῶν πολλαπλασίων—ἐνὸς εἵδους ὄντος τοῖς μὲν πολλαπλασίοις πρὸς τοὺς πολλαπλασίους ἐνὸς εἵδους, τοῖς δ' ἐπιμορίοις πρὸς τοὺς ἐπιμορίους ἐνὸς εἵδους; ἀποκληρωτικὸν γὰρ δοκεῖ καὶ οὐ καθολικὸν εἶναι τὸ εἰρημένον “ἐνὸς εἵδους ὄντος αὐτοῖς πρὸς ἐκείνους”.

καὶ ἔτι τὸ τὴν ἐκλογὴν

**ποιεῖσθαι τῶν συμφωνιῶν, καθ' ὃν αὐτοὶ βούλονται τρόπον. τῶν γὰρ
πρώτων τοὺς λόγους αὐτῶν ποιοῦντων ἀριθμῶν ἀφαιροῦντες ἐκατέρου
μονάδα ὑπὲρ τῆς ἐξ ἀμφοῖν ὁμοιότητος καὶ τοὺς λοιποὺς ἀριθμοὺς ὑπο-
τιθέμενοι τῶν ἀνομοίων, ἐφ' ὧν ἂν ταῦτα ἐλάττονα φαίνηται, συμφωνο- [5]
τέρας εἶναι φασιν, καὶ πάνυ γελοίως. ὃ τε γὰρ λόγος οὐ μόνον ἐπὶ τῶν
πρώτων αὐτὸν ποιοῦντων ἀριθμῶν ἰδίας ἐστίν, ἀλλὰ πάντων ἀπλῶς τῶν**

in lemma^{prim}: 13.25 πενταπλασίους] πολλαπλασίους codd.

in lemma^{sec}: 14.5 συμφωνότερα p 6 ἐπὶ om. p 7 ante πάντων add. καὶ p

distant extreme. In relation to the nearer extreme of the octave there are the simple concords by themselves, | that is, the fifth and the fourth; and the compound ones taken with the octave, that is, the octave plus a fifth or the octave plus a fourth are present in the relation to the more distant extreme of the octave. The rest of what he infers from this has been made clear in our earlier remarks. These points therefore pose a problem for the Pythagoreans, based in what comes to perception from the concord of an octave plus | a fourth; and he goes on to attack them with investigations grounded in reason. He writes as follows.

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Another crucial problem that affects them is the fact that they associate the concords only with those epimoric and multiple ratios and not with others – I mean such ratios as the epitetartics [5:4] and the five-times multiple [5:1] – though there is one form for both these and those. Ptol. *Harm.* 13.23–14.1

Why, he is asking, are only the epitritics and hemiolic among the epimoric ratios used in connection with the concords, and only the double and the triple among the multiples,⁴⁸³ while the rest of the epimorics and the | rest of the multiples are not? ‘Though there is one form’ – one form for multiples compared with multiples, and one form for epimorics compared with epimorics. For Ptolemy’s expression, ‘though there is one form for both these and those’ seems to be meant distributively and not collectively.⁴⁸⁴

... and <another problem is posed for the Pythagoreans> by the fact that they make their selection⁴⁸⁵ of the concords in whatever way suits their fancy. From each of the first numbers that make up their ratios they subtract a unit, representing the similarity between the two, and they assign the remaining numbers to the dissimilars; and the smaller these turn out to be, the more concordant they say they are – which is utterly absurd. For the ratio is not peculiar only to the first numbers that constitute it, but belongs

⁴⁸³ Porphyry seems to have inadvertently omitted the quadruple ratio of the double octave.

⁴⁸⁴ That is, it means that all multiples share the same form, and all epimorics share the same form, not that all multiples and epimorics share the same form. Ptolemy’s point may in fact be more specific: the multiples which the Pythagoreans do not assign to the concords have the same form as those they do assign, and similarly for the epimorics. This is a genuine difficulty for Greek exponents of mathematical harmonics. They are committed to the view that there is a clear-cut distinction between concords and discords, and also to the doctrine that all such musically significant distinctions are to be explained through mathematics. But there is no mathematical distinction to be drawn here. Ptolemy seems to be the only Greek theorist to have clearly enunciated the problem; but although in the next chapter he depicts the epimoric ratios as an unbroken continuum, linking the ‘discordant’ melodic intervals smoothly with the concords, he does not grasp the nettle and accept that there is no scientific basis for postulating a radical distinction between concords and discords. The later history of European music shows plainly how malleable and culturally sensitive the conception of concordance is.

⁴⁸⁵ As the sequel shows, they are ‘selecting’ concords in the sense that they are arranging them in order from the more concordant to the less.

ὁμοίως ἐχόντων πρὸς ἀλλήλους, ὥστε κάπὶ τούτων ἂν γίνοιτο τὸ παραπλήσιον, ποτὲ μὲν ὀλίγιστα, ποτὲ δὲ πλεῖστα τῶν αὐτῶν λόγων συνίστασθαι τὰ ἀνόμοια. [10]

- (15) Τῶν Πυθαγορικῶν τινες, ὡς Ἀρχύτας καὶ Δίδυμος ἱστοροῦσι, μετὰ τὸ καταστήσασθαι τοὺς λόγους τῶν συμφωνιῶν συγκρίνοντας αὐτοὺς πρὸς ἀλλήλους καὶ τοὺς συμφώνους μᾶλλον ἐπιδεικνύοναι βουλόμενοι τοιοῦτόν τι ἐποιοῦν. πρῶτους λαβόντες ἀριθμούς, οὓς ἐκάλουν πυθμένας, τῶν τοὺς λόγους τῶν συμφωνιῶν ἀποτελούντων—τουτέστιν ἐν οἷς ἐλαχίστοις ἀριθμοῖς αἱ συμφωνίαι ἀποτελοῦνται, ὡς λόγου χάριν ἢ μὲν διὰ πασῶν ἐν πρώτοις θεωρεῖται ἀριθμοῖς τοῖς β' καὶ α'· πρῶτος γὰρ διπλασίως ὁ δύο τοῦ ἑνὸς καὶ πυθμὴν τῶν ἄλλων διπλασίων· ἢ δὲ διὰ τεσσάρων ἐν ἐπιτρίτοις τοῖς τέσσαρσι καὶ τρισί· πρῶτος γὰρ ἐπίτριτος καὶ πυθμὴν ὁ δ' τῶν γ'. ὁ δὲ διὰ πέντε ἐν τρισί καὶ δύο· πρῶτος γὰρ ἡμιόλιος καὶ πυθμὴν ὁ γ' τοῦ β'—τούτους οὖν τοὺς ἀριθμούς ἀποδόντες ταῖς συμφωνίαις
- (24) ἐσκόπουν καθ' ἕκαστον λόγον—τῶν τοὺς ὅρους περιεχόντων ἀριθμῶν ἀφελόντες ἀφ' ἑκατέρων τῶν ὅρων ἀνὰ μονάδα—τοὺς ἀπολειπομένους ἀριθμούς μετὰ τὴν ἀφαίρεσιν, οἵτινες εἶεν, οἷον τῶν β' α', οἵπερ ἦσαν τῆς διὰ πασῶν· ἀφελόντες ἀνὰ μονάδα ἐσκόπουν τὸ καταλειπόμενον·
- (108) ἦν δ' ἔν τῶν δὲ δ' καὶ γ', οἵτινες ἦσαν τῆς διὰ τεσσάρων, ἀφελόντες ἀνὰ μονάδα εἶχον ἐκ μὲν οὖν τῶν τεσσάρων ὑπολειπόμενον τὸν τρία, ἐκ δὲ τῶν τριῶν τὸν δύο· ὥστ' ἀπὸ συναμφοτέρων τῶν ὅρων μετὰ τὴν ἀφαίρεσιν τὸ ὑπολειπόμενον ἦν πέντε. τῶν δὲ γ' καὶ β', οἵτινες ἦσαν τῆς διὰ πέντε, ἀφελόντες ἀνὰ μονάδα εἶχον ἐκ μὲν τῶν τριῶν ὑπολειπόμενα δύο, ἐκ δὲ τῶν δύο ὑπολειπόμενον ἓν, ὥστε τὸ συναμφοτέρον λειπόμενον εἶναι τρία. ἐκάλουν δὲ τὰς μὲν ἀφαιρουμένας μονάδας ὁμοία, τὰ δὲ λειπόμενα μετὰ τὴν ἀφαίρεσιν ἀνόμοια· διὰ δύο αἰτίας, ὅτι ἐξ ἀμφοῖν τῶν ὅρων ὁμοία ἢ ἀφαίρεσις ἐγένετο καὶ ἴση· ἴση γὰρ ἡ

19 τῶν om. V¹⁸⁷ 20 αἱ om Düring 22 πυθμὴν Alexanderson et Huffman πυθμένος codd.
24 ὁ δὲ — 24a τοῦ β' om. G et Düring 24a ἀποδίδοντες V¹⁸⁷ 27 β' καὶ α' Diels 28 τό] τόν V¹⁸⁷

1 ἔν] αἰί V¹⁸⁷ τῆς] τῶν V¹⁸⁷ 6—7 ὥστε συναμφοτέρον τὸ <ὑπο>λειπόμενον Diels

in lemmate 8 γίνοιτο ἂν p ὥστε εἰ κάπὶ τούτων γίνοιτο παραπλήσιον V¹⁸⁷

to absolutely all those that are related to one another in the same way, so that in their case too there would be a similar result, the combined dissimilars of the very same ratios turning out sometimes to be the smallest, sometimes the greatest.⁴⁸⁶ Ptol. *Harm.* 14.1–10

| After establishing the ratios of the concords, some of the Pythagoreans, as Archytas and Didymus record,⁴⁸⁷ compared them with one another and wanted to show which were the more concordant.⁴⁸⁸ They proceeded as follows. They took the first numbers, which they called ‘foundations’ (*pythmenes*), of those that produce the ratios of the concords – that is, the smallest | numbers in which concords are produced, as for instance the first numbers in which the octave is found are 2 and 1, since the first double is 2, the double of 1, and is the foundation of the other doubles; and the fourth <is first found> in the epitritics 4 and 3, since 4 in relation to 3 is the first and foundational epitritic – and they assigned these numbers to the concords. Then for every ratio of the numbers | comprising the boundaries, they considered which numbers were left after they had subtracted a unit from each of the boundaries. Thus they took a unit from each of the numbers 2 and 1, the numbers of the octave, and considered what was left, which was 1. From 4 and 3, the numbers of the fourth, they subtracted a unit each, and had 3 as the remainder of the 4 and 2 as the remainder of the 3. Thus after the subtraction the remainder from both terms together was 5. From 3 and 2, the numbers | of the fifth, they subtracted a unit each, and had 2 as the remainder of the 3 and 1 as the remainder of the 2, so that their combined remainder was 3. They called the subtracted units ‘similar’ (*homoia*), and the remainders left after the subtraction ‘dissimilars’ (*anhomoia*).⁴⁸⁹ This was for two reasons: the subtractions from each of the terms were similar (*homoia*) and equal, since unit is | equal to unit; and

[108D]

⁴⁸⁶ The result is ‘similar’, in the sense that just as the Pythagorean procedure establishes a ranking order between concords when their ratios are expressed by reference to the ‘first numbers’, i.e. in their lowest terms, so we shall get (absurdly) a ranking order between instances of the very same ratio (and therefore the same concord) if we represent it in several different ways. Thus if we represent the ratio of the fifth as 3:2 and subtract a unit from each term to represent the ‘similarity’, assigning the sum of the remaining numbers to the ‘dissimilarity’, the dissimilarity is 3. But if we represent it as 6:4 and pursue the same procedure, the dissimilarity will be 8, if we represent it as 9:6 it will be 13, and so on.

⁴⁸⁷ On Didymus see 5.11–14, and for quotations from his writings see 26.6–29, 27.17–28.26. Porphyry probably found Archytas’ account quoted or paraphrased in Didymus’ work.

⁴⁸⁸ The Greek would more naturally have roughly the sense ‘wanted to expound the concordant ratios more fully’, and this may be what Porphyry (or his source) intended.

⁴⁸⁹ Cf. Plato *Tim.* 80a–b.

- (10) μονὰς τῇ μονάδι· ὧν ἀφαιρουμένων ἐξ ἀνάγκης τὰ ὑπολειπόμενα ἀνόμοια καὶ ἄνισα. ἐὰν γὰρ ἀπ' ἀνίσων ἴσα ἀφαιρεθῇ, τὰ λοιπὰ ἔσται ἄνισα. οἱ δὲ πολλαπλάσιοι λόγοι καὶ ἐπιμόριοι, ἐν οἷς θεωροῦνται αἱ συμφωνίαι, ἐν ἀνίσοις ὅροις ὑφεστήκασιν, ἀφ' ὧν ἴσων ἀφαιρουμένων τὰ λοιπὰ πάντως ἄνισα. γίνεται οὖν τὰ ἀνόμοια τῶν συμφωνιῶν συμμιγέντα· συμμίσγειν δὲ λέγουσιν οἱ Πυθαγόρειοι τὸ ἓνα ἐξ ἀμφοτέρων ἀριθμὸν λαβεῖν. ἔσται οὖν τὰ ἀνόμοια συντεθέντα καθ' ἑκάστην τῶν συμφωνιῶν τοιαῦτα· τῆς μὲν διὰ πασῶν ἓν, τῆς δὲ διὰ τεσσάρων πέντε, τῆς δὲ διὰ πέντε τρία. ἐφ' ὧν δ' ἂν φασὶ τὰ ἀνόμοια ἐλάσσονα ἦ, ἐκεῖνα τῶν ἄλλων εἰσὶ συμφωνότερα. σύμφωνον μὲν ἔστιν ἡ διὰ πασῶν, ὅτι ταύτης τὰ ἀνόμοια ἓν· μεθ' ἣν ἡ διὰ πέντε, ὅτι ταύτης τὰ ἀνόμοια τρία· τελευταία δ' ἡ διὰ τεσσάρων, ὅτι ταύτης τὰ ἀνόμοια πέντε.

- Ταῦτ' ἔστιν ἃ εἶρηκεν ὁ Πτολεμαῖος, φάσκων τὴν ἐκλογὴν τῶν συμφωνιῶν, καθ' ὃν αὐτοὶ βούλονται τρόπον, γελοῖαν εἶναι· ἐκλογὴν δὲ λέγει τὴν πρὸς τὸ κρεῖττον ἀπονέμησιν. εἰ γὰρ πασῶν οὐσῶν συμφωνιῶν φαίνοιτό τις αὐτῶν συμφωνότερα, ἐκλεκτικωτέρα ἂν εἴη αὕτη. γελοῖαν δ' οὐ τὴν προτίμησιν φησὶν εἶναι τῆς διὰ πασῶν, οὐδ' ὅτι τὴν διὰ πέντε μετὰ τὴν διὰ πασῶν προκρίνουσι τῆς διὰ τεσσάρων, ἀλλὰ τὸν τρόπον, δι' οὗ τὸ τιμιώτερον ἐν αὐταῖς ἐφοδεύουσιν. διὰ δὲ τῶν εἰρημένων δηλα καὶ τὰ ὑπ' αὐτοῦ συντόμως καὶ ἁσαφῶς εἰρημένα. τῶν γὰρ ἀριθμῶν φησι, οἵτινες πρῶτοι ποιοῦσι τοὺς λόγους τῶν συμφωνιῶν, ἀφαιροῦντες ἑκατέρου τῶν ἀριθμῶν μονάδα ὑπὲρ τῆς ἐξ ἀμφοῖν ὁμοιότητος τοὺς λοιποὺς μετὰ τὴν ἀφαίρεσιν ἀριθμούς, οἳ εἰσι τῆς ἀνομοιότητος, λαμβάνοντες καθ' ἑκάστην συμφωνίαν, ἐφ' ὧν ἂν συμφωνιῶν τὰ ἀνόμοια ταῦτα ἐλάσσονα φαίνηται, συμφωνοτέρας ταύτας λέγουσιν εἶναι.

13 ἀνίσοις] ἴσοις G 13-14 πάντως] πάντα GV¹⁸⁷ 14-15 συμμίγειν V¹⁸⁷ 15 ἀριθμῶν p
18 ἐλάσσονα — 20 ἀνόμοια^{prim.} om. V¹⁸⁷ 19 εἰσί] ἐστί G 33 ἂν om. G

if equals are subtracted from unequals, what is left will be unequal.⁴⁹⁰ The multiple and epimoric ratios, in which the concords are found, are constituted from unequal terms, and when equals are subtracted from them the remainders will always be unequal. In the concords, then, the dissimilars arise when they have been blended; | the Pythagoreans use the word 'blending' (*symmisgein*) for the construction of one number out of the two.⁴⁹¹ The dissimilars put together in the case of each of the concords are these: for the octave, 1; for the fourth, 5; for the fifth, 3. They say that those whose dissimilars are smaller are more concordant than the others. The octave is concordant,⁴⁹² since its | dissimilars are 1; after it comes the fifth, since its dissimilars are 3; and last is the fourth, since its dissimilars are 5.⁴⁹³

This is what Ptolemy is talking about when he says that their selection of the concords, 'in whatever way suits their fancy', is absurd. By 'selection' (*eklogē*) he means their ranking in order of excellence. For if any one of all the concords | were perceptibly more concordant than the others, it would be more worthy of selection. What he calls 'absurd' is not the priority assigned to the octave, nor the fact that after the octave they judge the fifth to be better than the fourth, but the method by which they proceed in identifying the more estimable among them. What we have said also clarifies things that he has said summarily and unclearly. From each of the first numbers | that make up the ratios of the concords, he says, they subtract a unit, representing the similarity between the two, and they take for each concord the numbers left after the subtraction, which are those of the dissimilarity; and in whichever of the concords these dissimilars are shown to be smaller, these concords, they say, are more concordant.

⁴⁹⁰ No doubt Porphyry's explanation is right as far as it goes. But he has pointed out earlier (82.28) that the adjective *homoios* refers to a qualitative relation and *isos* (equal) to a quantitative relation. His own use of *homoios* in this sentence is obviously meant to echo the Pythagorean terminology, but it is not clear how it can properly fit into the sentence's quantitative environment. I suspect that in choosing the language of 'similarity' rather than 'equality', the Pythagoreans may have intended to convey something over and above the obvious point that Porphyry makes.

⁴⁹¹ More literally, 'for obtaining (*labein*) one number ...' (I borrow 'obtaining' from Huffman (2005): 443).

⁴⁹² Perhaps this should be emended to 'the most concordant'.

⁴⁹³ For discussion of this ingenious procedure see Barker (1989): 34–5 and (2014): 193–5, Huffman (2005): 428–43, cf. Zhmud (2006): 214–18. It may indeed be flawed, as Ptolemy (seconded by Porphyry) argues, though I now think that all their criticisms may be answerable. I suspect that it is based on the thesis set out in the *Sect. can.*, the *De audib.* and the passage Porphyry quotes from Heraclides (90.7–22, 75.14–27, 30.27–31.21 above), that each note is the product of a succession of separate impacts. In the case of a concord, the 'similars' are the impacts within each of the two notes that occur at exactly the same moment and the 'dissimilars' are those that do not. But the procedure is in any case by no means ridiculous – Porphyry explains the idea behind it in more general terms perceptively at the end of the next paragraph (108.29–34).

- (109) Σαφοῦς τοίνυν τῆς ἐφόδου τῶν Πυθαγορείων γεγонуίας ἐκ τῆς τοῦ Πτολεμαίου λέξεως, ἄξιον ἰδεῖν, καὶ τί ἀντιλέγει πρὸς ἑκάτερα, λέγω δ' ἑκάτερα τό τε μὴ πᾶσι χρῆσθαι τοῖς λόγοις, ἀλλὰ τοῖς πρώτοις καὶ πυθ- μέσιν ἐπὶ τῶν συμφωνιῶν, καὶ τὸ ἐκ τῶν ἀνομοίων τῶν ὀλίγων κρίνειν
- (5) τῶν συμφωνιῶν τὰς συμφωνοτέρας. φησὶ δ' εὐλόγως ἄμφω γελοῖα εἶναι. διὰ τί γὰρ ἐπὶ μὲν τῶν πρώτων ποιοῦντων ἀριθμῶν τοὺς λόγους τὴν παράδοσιν οἱ Πυθαγόρειοι πεποίηται, ἀλλ' οὐχὶ καὶ ἐπὶ τῶν ἄλλων; οἱ γὰρ λόγοι κοινοὶ πάντων τῶν ὁμοίως ἐχόντων πρὸς ἀλλήλους εἰσὶν· οὐ γὰρ διὰ τῶν δύο καὶ ἑνός, φέρε εἰπεῖν, ὁ διπλάσιος λόγος ἦν ἴδιος,
- (10) ὅτι πρῶτος ἐν τούτοις ὑφίσταται, ἀλλὰ δῆλον, ὅτι καὶ τοῦ δ' πρὸς τὸν β' καὶ τοῦ ζ' πρὸς τὸν γ' καὶ πάντων τῶν ὁμοίων ἀλλήλων ἐστὶ κοινός. τὸ αὐτὸ δὲ λέγοιτ' ἂν καὶ ἐπὶ τοῦ ἡμιολίου λόγου καὶ ἐπιτρίτου καὶ τῶν ἄλ- λων λόγων. εἰ οὖν συγχωρήσειέ τις ἀπλῶς καὶ ἐπὶ πάντων τῶν ὁμοίων λόγων τὴν ἐξέτασιν γίνεσθαι, ἀλλ' οὐκ ἐπὶ μόνων τῶν πρώτων ποιοῦν- των ἀριθμῶν τοὺς λόγους, ἄτοπόν τι συμβήσεται. τοῦ γὰρ αὐτοῦ λόγου τὰ ἀνόμοια ποτὲ μὲν ἔσται ὀλίγιστα, ποτὲ δὲ πλεῖστα, οἷον ἐπὶ τοῦ διπλα- σίου, β' καὶ α', καταλείπεται τὰ ἀνόμοια ἕν' καὶ ὁμοίως ἐπὶ τοῦ δ' πρὸς β' διπλασίου, δ' τὰ ἀνόμοια· ἀπὸ δὲ τοῦ η' πρὸς δ' ἔσται τὰ ἀνόμοια δέκα· καὶ κατὰ τὸν λόγον αἰεὶ προσθέσεως γινομένης δεκάδων καὶ ἑκα- τοντάδων καὶ χιλιάδων ἔσται πλεῖστα τὰ λειπόμενα τῶν ἀνομοίων. πρὸς δὲ τούτοις καὶ τοιαύτην ἀπάντησιν αὐτοῖς προσάδει, ἣν καὶ οἰκειότεραν φησὶν εἶναι πρὸς τὴν ἐπιχείρησιν. παρακείσθω δ' αὕτη πάλιν ἡ λέξις, ἔχουσα οὕτως.
- (15)
- (20)

ἐὰν γάρ, ὅπερ ἂν δόξειε τῆς ἐπιχειρήσεως οἰκειό- [10]
τερον, τὸν αὐτὸν ἀριθμὸν ἅπασι τοῖς ἐλάττωσιν ὅροις ὑποβάλλωμεν,
οἷον τὰ ἕξ, καὶ τοὺς ἴσους αὐτῶ τῶν μειζόνων ἀφαιροῦντες ἀντὶ τῆς
ὁμοιότητος τοὺς λειπομένους συγκρίνωμεν ὡς τῶν ἀνομοίων περιεκτι-
κούς, κατὰ μὲν τὸν διπλάσιον ἕξ ἔσται ταῦτα, κατὰ δὲ τὸν ἡμιόλιον
τρία, κατὰ δὲ τὸν ἐπίτριτον δύο, καὶ πλείω τὰ ἀνόμοια τῶν συμφωνοτέ- [15]
ρων.

- (25) Οἰκειότεραν μὲν οὖν λέγει τὴν ἐπιχείρησιν, ἐπεὶ τὴν διαβολὴν ποιεῖται τοῦ λόγου διὰ τῶν δεδομένων ὑποθέσεων. ποιεῖται δ' οὕτως. ὥσπερ οἱ Πυθαγόρειοι μονάδα μὲν ἀφαιροῦντες ἀφ' ἑκατέρου τῶν ὄρων τῶν

2 λέγω δ' ἑκάτερα οπ. V¹⁸⁷ 5 εὐλόγως G ἀλόγως ceteri 9 διὰ τῶν] δὴ G 22 φησὶν V¹⁸⁷
 φασὶν ceteri ἐπιχείρησιν Höeg (1934) ἐπίχρησιν codd. 27-8 τῶν πρώτων ποιοῦντων Alexander-
 son τοὺς πρώτους ποιοῦντας codd.

Now that the Pythagoreans' procedure has been made clear on the basis of Ptolemy's statements, it is worth considering also what he says in opposition to both positions, where by 'both positions' I mean both their not using all the ratios for the concords but only those that are the first and foundational, and their judging the more concordant of these few concords| on the basis of the dissimilars. He says with good reason that both are absurd. For why have the Pythagoreans presented their doctrine by reference to the first numbers that make the ratios and not to the others? For the ratios are common to all the numbers related to one another in the same way. Thus the double ratio, for instance, is not peculiar to the relation between 2 and 1, | just because it is first instantiated in them, but it is obviously shared in common also by 4 in relation to 2 and by 6 in relation to 3, and by all others of the same sort. One can say the same thing about the hemiolic ratio and the epitritic and the other ratios. Then if one were to agree that the exposition should include all the ratios that are the same, and not just the first | numbers that make the ratios, the result would be bizarre. For the dissimilars of the same ratio would sometimes be very small and sometimes very large. Thus for instance in the double ratio of 2 and 1, the dissimilars left are 1; and in the same way in the double ratio of 4 to 2 the dissimilars are 4, while in that of 8 to 4 the dissimilars will be 10. And with continuous increase in <the terms of> the ratio, most of the remainders constituting the dissimilars will run into tens and | hundreds and thousands. In view of these points he sings⁴⁹⁴ them the following response, which he says is more appropriate to this project. Let us again set out his actual words, which are these.

For if, as would seem more appropriate to their project, we assign the same number to all the smaller boundaries, the number 6, for example, and if after subtracting numbers equal to this from the greater terms, to represent the similarity, we reckon the combined remainders as comprising the dissimilars, this will be 6 in the case of the double ratio and 3 in the case of the hemiolic, and the dissimilars of the more concordant will be greater. Ptol. *Harm.* 14.10–16

| He calls this approach 'more appropriate' because he is launching his attack on their thesis by means of the principles that have been given.⁴⁹⁵ He does it in this way. Just as when the Pythagoreans posited the numbers

⁴⁹⁴ The verb is *prosāidei*. This use of a musical expression may or may not be ironical; if it is, it seems to be one of Porphyry's rare flashes of humour.

⁴⁹⁵ This probably means that he is using the principles of the Pythagoreans' own procedure in order to undermine it; a strategy 'more appropriate' to their project will bring out its absurdity.

- πρώτων ποιούντων τὸν λόγον ὑπετίθεντο ἀριθμούς, οὕτως ὁ Πτολεμαῖος φησιν ὁ μέλλων ἀφαιρεῖσθαι τῆς ὁμοιότητος ἀριθμὸς ὁ ζ΄· τουτέστιν
- (30) ἀφ' ἑκατέρων τῶν ὄρων τῶν περιεχόντων τὸν λόγον ἀφαιρεῖσθω ὁ ζ΄ <τῶν> ποιούντων τοὺς λόγους τῶν συμφωνῶν, ἵνα κατὰ πᾶν ἡ παραβολὴ ὁμοία ᾖ. ἦσαν γὰρ καὶ ὑπ' ἐκείνων λαμβανόμενοι ἀριθμοὶ οἱ πρῶτοι καὶ πυθμένες
- (110) τῶν λόγων. ἔσονται τοίνυν ἐν τοῖς τρισὶ λόγοις, τῷ τε διπλασίῳ λέγω καὶ τῷ ἡμιολίῳ καὶ τῷ ἐπιτρίτῳ, τοῦ ἐλαχίστου τοῦ ὄρου ὄντος ἕξ, οἱ ἀριθμοὶ τῶν ὄρων τοιοῦτοι· τοῦ μὲν διπλασίου ἰβ' καὶ ζ', τοῦ δ' ἡμιολίου θ' καὶ ζ', τοῦ δ' ἐπιτρίτου ἡ' καὶ ζ'. καὶ εἴ γ' ἀνὰ ἕξ ἀφέλοιμεν ἀπὸ
- (5) τῶν ὄρων τοὺς τῆς ὁμοιότητος, λειφθήσεται ἀνόμοια ἐπὶ μὲν τοῦ διπλασίου ζ', ἐπὶ δὲ τοῦ ἡμιολίου γ', ἐπὶ δὲ τοῦ ἐπιτρίτου β'. οὐκοῦν ἐλάχιστα μὲν ἔσται τὰ ἀνόμοια τοῦ ἐπιτρίτου, ἔπειτα δὲ τὰ τοῦ ἡμιολίου, πλεῖστα δὲ τὰ τοῦ διπλασίου. καὶ διὰ τοῦτο συμφωνότατον μὲν ἔστι τὸ διὰ τεσσάρων, δεύτερον δὲ τὸ διὰ πέντε, ἥττον δὲ καὶ τελευταῖον τὸ διὰ πασῶν·
- (10) ὅπερ οὐδ' αὐτοῖς δοκεῖ. ταῦτα μὲν οὖν παραβάλλων πρὸς τὴν ἐκείνων ἐπιχείρησιν εἴρηκεν, λοιπὸν δὲ καὶ καθ' αὐτὴν ἀνατρέπων αὐτὴν ἐπάγει ταῦτα.

ὅλως δὲ καὶ κατὰ τὴν αὐτῶν ἔφοδον μετὰ τὸ διὰ πασῶν τὸ διὰ πασῶν καὶ διὰ πέντε συμφωνότερον ἀποδείκνυται τῶν λοιπῶν, δύο μὲν ἐν αὐτῷ καταλειπομένων τῶν ἀνομοίων, πλείονων δὲ ἐν ἅπασι τοῖς ἄλλοις, οἷον τριῶν ἐν τε τῷ διὰ πέντε καὶ ἐν τῷ δις διὰ πασῶν, ἑκατέρου τούτων ἐναργέστατα συμφωνοτέρου καθισταμένου τοῦ διὰ πασῶν καὶ [20] διὰ πέντε μάλα εἰκότως.

- (15) Πρῶτον ἰδεῖν χρὴ, πῶς κατὰ τοὺς Πυθαγορείους τὸ διὰ πασῶν καὶ διὰ πέντε συμφωνότερόν ἐστι τοῦ διὰ πέντε καὶ ὁμοίως τοῦ δις διὰ πασῶν, ἑκατέρου συμφωνοτέρου

31 <τῶν> ποιούντων scripsi ποιῶν Düring ποιούντες codd.

1 διπλασίῳ V⁸⁷ διὰ πασῶν ceteri 10 οὐδ' scripsi anonymum lectorem secutus οὐ δ' Düring 16–17 ἑκατέρου συμφωνοτέρου ὄντος Alexanderson ἑκάτερον συμφωνότερον εἶναι codd. ante ἑκάτερον add. <καὶ τὸ διὰ πέντε καὶ τὸ δις διὰ πασῶν> Düring

in lemmate: 14.16 τὸ διὰ πασῶν om. codd.

21 ante μάλα add. τοῦ διὰ πέντε καὶ codd.

by subtracting a unit from each of the first terms that make the ratio, so Ptolemy says that the number that will be subtracted, the number of the similarity, is 6. That is, | from each of the terms that comprise the ratio, among those that make up the ratios of the concords, let the number 6 be subtracted, so that the comparison may be on the same footing in all respects. For the numbers used by the Pythagoreans too were the first and foundational numbers of the ratios.⁴⁹⁶ Thus since the smallest term is 6 in all three ratios – I mean the double, the hemiolic and the epitritit [110D] – the numbers of the terms will be these: in the double 12 and 6, in the hemiolic 9 and 6, and in the epitritit 8 and 6. And if we subtract 6, the number of the similarity, from | the terms, the dissimilars that remain will be these: 6 in the double, 3 in the hemiolic and 2 in the epitritit. Thus the dissimilars of the epitritit will be the smallest, next will be those of the hemiolic, and the greatest will be those of the double. Through this reasoning the most concordant is the fourth, the second is the fifth, and the least concordant and last is the octave, | which not even the Pythagoreans believe.⁴⁹⁷ In saying these things he has constructed a parallel with their procedure. Next he adds the following, to overturn the procedure in itself.⁴⁹⁸

In any case, by their method, the octave plus a fifth is proved to be more concordant than the rest, after the octave, since the dissimilars remaining in it amount to 2, and are more in all the others, being 3 in the fifth and in the double octave, for example, each of which is patently more concordant in its constitution than the octave plus a fifth, as one would surely expect. Ptol. Harm. 14.16–21

First we must see how it is that according to the Pythagoreans, the octave plus | a fifth is more concordant than the fifth and also than the double octave, while in fact each of them is more concordant than the octave plus

⁴⁹⁶ In saying ‘by the Pythagoreans too’, Porphyry may mean that their practice of putting each of the ratios in its lowest terms was intended, like Ptolemy’s alternative, to put them all on the same footing.

⁴⁹⁷ If the suggestion I offered in n. 493 above is correct, this criticism fails. The octave (2:1) will be conceived as 12:6 only when the notes have persisted through six cycles of impacts. There will thus have been six moments when impacts from the two notes coincide, so that the number to be subtracted from each term will be 6, and the ‘dissimilars’ also amount to 6, as Ptolemy and Porphyry say. But the fifth (3:2) will be represented as 9:6 when the notes have persisted through only three cycles; the ‘similars’ will add up to 6, and the ‘dissimilarity’ will be 9. In the fourth (4:3), by the same reasoning, the ‘dissimilarity’ will be 10. Hence the correct ordering of these concords will be preserved.

⁴⁹⁸ This seems to mean that as Porphyry construes it, Ptolemy has so far done no more than to describe an alternative procedure, parallel to that of the Pythagoreans, which leads to the opposite results, but has not given reasons for preferring one of them to the other. Hence their procedure has not yet been shown to be intrinsically unacceptable.

- ὄντος τοῦ διὰ πασῶν καὶ διὰ πέντε. ἐπεὶ οὖν τὸ διὰ πασῶν καὶ διὰ πέντε ἐν τριπλασίονι λόγῳ ἐστί, πρῶτα δὲ τοῦ τριπλασίου ἀριθμοῦ τὰ τρία πρὸς τὸ ἓν, τὸ δὲ διὰ πασῶν ἐν διπλασίονι λόγῳ, ταῦτα δ' ἦν ἐν πρώτῳ
- (20) ἀριθμῷ δύο πρὸς ἓν, τὸ δὲ διὰ πέντε ἐν ἡμιολίῳ λόγῳ καὶ πρώτοις ἀριθμοῖς ἦν τοῖς γ' πρὸς τὰ β', τὸ δὲ δις διὰ πασῶν ἐν τετραπλασίονι λόγῳ κείμενον θεωρεῖται ἐν πρώτοις ἀριθμοῖς ἐν σχέσει δ' πρὸς τὸ ἓν· ἔσονται ἡμῖν λόγοι τοῦ μὲν τριπλασίου λόγου γ' α', τοῦ δὲ διπλασίου β' α', τοῦ δὲ ἡμιολίου γ' β', τοῦ δὲ τετραπλασίου δ' α'. ὣν τῆς ὁμοιότητος
- (25) ἂν ἀφέλωμεν ἀνὰ μονάδα, τὰ λοιπὰ ἔσται τὰ ἀνόμοια, τοῦ μὲν τριπλασίου β', τοῦ δὲ διπλασίου α', τοῦ δ' ἡμιολίου γ' καὶ τετραπλασίου γ'. ὥστε τὸ μετὰ τὸ διὰ πασῶν ὀλίγα τὰ ἀνόμοια ἔσται τοῦ τριπλασίου, β' γάρ· τῶν δὲ λοιπῶν ἀνὰ γ'. καὶ ἔστιν ὁ μὲν διπλάσιος λόγος τοῦ διὰ πασῶν, ὁ δὲ τριπλάσιος τοῦ διὰ πασῶν καὶ διὰ πέντε, ὁ δὲ ἡμιόλιος τοῦ
- (30) διὰ πέντε, ὁ δὲ τετραπλάσιος τοῦ δις διὰ πασῶν. συμφωνότερον ἡμῖν μετὰ τὸ διὰ πασῶν ἔσται τὸ διὰ πασῶν καὶ διὰ πέντε, καὶ τοῦ διὰ πέντε συμφωνοτέρου ὄντος αὐτοῦ, ὡς δείξει, καὶ ὁμοίως τοῦ δις διὰ πα-
- (III) σῶν. τὸ μὲν οὖν μόνον τὸ διὰ πέντε συμφωνότερον εἶναι τοῦ διὰ πασῶν καὶ διὰ πέντε καὶ μάλα εἰκότως φησὶν

ἐπειδὴ τὸ μὲν διὰ πέντε τοῦ διὰ πέντε καὶ διὰ πασῶν ἀπλούστερόν τέ ἐστι καὶ ἀσυνθετώτερον καὶ οἰονεὶ ἀκρατοτέρου συμφωνίας,

- (4) Τὸ δ' ἄκρατον, ἀμεικτον ὃν καὶ καθαρώτερον, καὶ καθ' ἕκαστον γένος
- (5) τὴν οἰκείαν ἔχει δύναμιν ἰσχυροτέραν διαμένουσαν. οὕτως οὖν καὶ ἐν τοῖς συμφώνοις τὸ ἄκρατον, ὅπερ ἦν τὸ διὰ πέντε, συμφωνότερον τοῦ συνθέτου τοῦ διὰ πασῶν καὶ διὰ πέντε. τὸ δὲ δις διὰ πασῶν εἶναι συμφωνότερον τοῦ διὰ πασῶν καὶ διὰ πέντε δέικνυται οὕτως. λέγει δὲ κατὰ λέξιν αὐτοῦ ταῦτα.

22 ἐν σχέσει Düring τὸ ἐν ἔχει codd.

24 τετραπλασίου δὲ p δ' α'] διὰ V¹⁸⁷

7 εἶναι Alexanderson ἔστι codd.

a fifth. Now the octave plus a fifth is in triple ratio, and the first case of a tripled number is 3 in relation to 1; the octave is in double ratio, and this, in the first | numbers, is 2 in relation to 1; the fifth is in hemiolic ratio and in the first numbers is 3 in relation to 2; and the double octave, which is in quadruple ratio, is found in the first numbers in the relation of 4 to 1. We shall therefore treat the triple ratio as 3:1, the double as 2:1, the hemiolic as 3:2 and the quadruple as 4:1. If | we subtract a unit from each of their terms, for the similarity, the remainders, the dissimilars, will be: of the triple, 2; of the double, 1; of the hemiolic 3; and of the quadruple, 3. Thus after that of the octave, the smallest dissimilars will be those of the triple, since they are 2, while the others are both 3; and the double ratio is that of the octave, the triple is that of the octave plus a fifth, the hemiolic is that of the | fifth and the quadruple is that of the double octave. We shall therefore find that the most concordant after the octave is the octave plus a fifth, though in fact, as Ptolemy will show, the fifth is more concordant than it, and so is the double octave. He says, very reasonably, that the fifth taken alone is more concordant than the octave plus a fifth,⁴⁹⁹

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because the fifth is simpler and less complex than the fifth plus an octave, and its concordance is as it were purer. Ptol. *Harm.* 14.21–3

In every class of things, that which is unblended, being unmixed and most pure, | maintains the character⁵⁰⁰ proper to it more strongly and persistently. So too among the concords, that which is unblended, which in this case is the fifth, is more concordant than the compound of the octave plus a fifth.⁵⁰¹ He shows that the double octave is more concordant than the octave plus a fifth in the following way; this is what he says, in precisely these words:

⁴⁹⁹ Porphyry makes his sentence run on into the lemma that follows. The results laid out in this passage do indeed cast doubt on the Pythagorean procedure. But there is nothing in Ptolemy's or Porphyry's account to indicate that those who adopted it applied it to any concord greater than the octave, or – if they did – how they handled the problems. We have already been told that the Pythagoreans treated the octave plus a fifth and the double octave as concords, though not the octave plus a fourth; but the only evidence given for this comes from periods later than the pre-Archytan Pythagoreans whose procedure is under discussion here. As a formal structure, the two-octave system was developed in the fourth century (or in the late fifth, at the earliest), and these Pythagoreans (like Philolaus, for instance) may not have known or considered any structures extending beyond the octave. Except in a few isolated cases, notably when referring to Archytas, Ptolemy and Porphyry treat 'Pythagorean' harmonics as a body of doctrines and procedures that never changed in the course of its history; but of course it did.

⁵⁰⁰ Or 'power'; the noun is *dynamis*.

⁵⁰¹ The notions of 'blending' and 'mixing' at work in these sentences have nothing to do, of course, with the 'blending' of the two notes that form a concord.

τὸ δὲ δις διὰ πασῶν οὕτως ἔχει πρὸς τὸ διὰ πέντε καὶ διὰ πασῶν, τουτέστιν ὁ τετραπλάσιος λόγος πρὸς τὸν τριπλάσιον, ὡς μόνον τὸ διὰ πασῶν πρὸς μόνον τὸ διὰ πέντε, τουτέστιν ὁ διπλάσιος λόγος [25] πρὸς τὸν ἡμιόλιον. ἐὰν γὰρ ἐνὸς ἀριθμοῦ ληφθῶσι τριπλάσιός τε καὶ τετραπλάσιος καὶ πάλιν ἡμιόλιός τε καὶ διπλάσιος, ἐπίτριοι ποιήσουσι λόγον ὁ τετραπλάσιος πρὸς τὸν τριπλάσιον καὶ ὁ διπλάσιος πρὸς τὸν ἡμιόλιον, ὥστε ὅσον συμφωνότερόν ἐστι τὸ διὰ πασῶν τοῦ διὰ πέντε, [15] τοσοῦτον συμφωνότερον γίνεσθαι καὶ τὸ δις διὰ πασῶν τοῦ διὰ πασῶν καὶ διὰ πέντε.

- (11) Πρὸς δὲ τὴν τούτων σαφήνειαν λαμβάνεται θεώρημά τι τοιοῦτον. ἐὰν ἐνὸς ἀριθμοῦ ὁ μὲν τις ἀριθμὸς ἢ τετραπλάσιος, ὁ δὲ τριπλάσιος, καὶ ἔτι τοῦ αὐτοῦ ὁ μὲν διπλάσιος, ὁ δ' ἡμιόλιος· ἡ ὑπεροχὴ τοῦ τετραπλασίου πρὸς τὸν τριπλάσιον ἐπίτριοι ποιοῦσα λόγον ἢ αὐτὴ ἔσται τῇ ὑπεροχῇ τοῦ διπλασίου πρὸς τὸν ἡμιόλιον· ἔστι γὰρ αὐτὴ ἐν ἐπιτρίτῳ λόγῳ. οἷον τοῦ β' ἀριθμοῦ ἔστω τετραπλάσιος μὲν ὁ δ', τριπλάσιος δ' ὁ ζ', καὶ πάλιν τοῦ β' διπλάσιος μὲν ὁ δ', ἡμιόλιος δ' ὁ γ'. ἐὰν ἄρα ἀπὸ τοῦ η' πρὸς τὰ β' λόγου, ὄντος τετραπλασίου, ἀφέλωμεν τὸν τῶν ζ' πρὸς τὰ β' λόγον, ὄντα τριπλάσιον, λείπεται λόγος τῶν η' πρὸς τὰ ζ' καὶ πάλιν (20) ἐὰν ἀπὸ τοῦ δ' πρὸς τὰ β' λόγου, ὄντος διπλασίου, ἀφέλωμεν τὸν τῶν γ' πρὸς τὰ β' λόγον, ἡμιόλιον ὄντα, λείπεται λόγος ὁ τῶν δ' πρὸς τὰ γ' ὁ αὐτός· εἰσὶ γὰρ ἄμφω ἐπίτριοι. ὥσθ' ὃν ἔχει ὁ διπλάσιος λόγον πρὸς τὸν ἡμιόλιον, τουτέστι τὰ δ' πρὸς τὰ γ', τοῦτον ἔχει τὸν λόγον ὁ τετραπλάσιος πρὸς τὸν τριπλάσιον. ὥ γὰρ ὑπερέχει ὁ τετραπλάσιος τοῦ τριπλάσιου, τοῦτ' ὑπερέχει ὁ διπλάσιος τοῦ ἡμιολίου. καὶ γὰρ διπλασιασθεὶς ὁ μὲν ἡμιόλιος τὸν τριπλάσιον ποιεῖ, ὁ δὲ διπλάσιος τὸ τετραπλάσιον· καὶ τὸν αὐτὸν δὲ λόγον ἔχει ὁ τετραπλάσιος πρὸς τὸν διπλάσιον καὶ ὁ τριπλάσιος πρὸς τὸν ἡμιόλιον.

- Τούτων δ' οὕτως ἐχόντων ἐπεὶ τὸ δις διὰ πασῶν ἐν τετραπλασίονι (30) λόγῳ θεωρεῖται, τὸ δὲ διὰ πασῶν καὶ διὰ πέντε ἐν τριπλασίῳ, τὸ δὲ διὰ πασῶν μόνον ἐν διπλασίῳ, τὸ δὲ διὰ πέντε μόνον ἐν ἡμιολίῳ, οὕτως ἄρα ἔξει τὸ δις διὰ πασῶν πρὸς τὸ διὰ πασῶν καὶ διὰ πέντε, ὡς τὸ μόνον διὰ πασῶν πρὸς τὸ μόνον διὰ πέντε· ὥσθ' ὅσῳ τὸ μόνον διὰ πασῶν συμφωνότερόν ἐστι τοῦ μόνον διὰ πέντε, τοσοῦτ' καὶ τὸ δις διὰ πασῶν συμφωνότερόν ἐστι τοῦ διὰ πασῶν καὶ διὰ πέντε.

18 τὸν] τό Düring 28 πρὸς om. g 29 τετραπλασίῳ p

in lemmate^{ecc}: 14.29 ὅσῳ — 15.1 τοσοῦτον om. codd.

3 τέλος τοῦ ἔκτου κεφαλαίου add. p 4 ζ' εἰς τὸ δέον οὖν εἴη τὰς τοιαύτας ἀμαρτίας G ἀρχὴ τοῦ ἐβδόμου κεφαλαίου εἰς τὸ δέον οὖν εἴη τὰς p

| The relation of the double octave to the fifth plus an octave – that is, of the quadruple ratio to the triple – is the same as that of the octave alone to the fifth alone – that is, of the double ratio to the hemiolic. For if the triple and the quadruple, and again the hemiolic and the double of a single number are taken, the quadruple will be in epitrititic ratio to the triple, and so will the double to the hemiolic. Thus however much more concordant the octave is than the fifth, the double octave is more concordant than the octave plus a fifth to the same extent. Ptol. *Harm.* 14.23–15.2

To clarify these remarks one takes a theorem of the following sort. If some number is the quadruple and another the triple of one number, and some number is the double and another the hemiolic of the same number, the excess of the quadruple over the triple, which makes the epitrititic ratio, will be the same as the excess | of the double over the hemiolic; for it, too, is in epitrititic ratio.⁵⁰² Of the number 2, for instance, let there be the quadruple, 8, the triple, 6, the double, 4, and the hemiolic, 3. Then if from the ratio 8:2, which is quadruple, we subtract the ratio 6:2, which is triple, what is left is the ratio 8:6. And again, | if from the ratio 4:2, which is double, we subtract the ratio 3:2, which is hemiolic, what is left is the ratio 4:3; and that is the same, since both are epitrititics. Thus the ratio of the double to the hemiolic, 4:3, is the same as that of the quadruple to the triple. For that by which the quadruple exceeds the triple | is the same as that by which the double exceeds the hemiolic. For when the hemiolic is doubled it makes the triple,⁵⁰³ and when the double is doubled it makes the quadruple; and the quadruple has the same ratio to the double as does the triple to the hemiolic.

Given that these things are so, since the double octave is in quadruple | ratio, the octave plus a fifth in triple ratio, the octave taken alone in double ratio and the fifth taken alone in hemiolic ratio, the double octave will be related to the octave plus a fifth in the same way as the octave taken alone is related to the fifth taken alone. Thus by however much the octave taken alone is more concordant than the fifth taken alone, the double octave is more concordant than the octave plus a fifth by the same amount.

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⁵⁰² The term 'excess' (*hyperochē*) is not used here (as it is by some of the theorists discussed at 91.4–95.19 above) to refer to the absolute amount by which one quantity exceeds another; if it were, the ratios would be the same, but the 'excesses' would not. As in most cases where Ptolemy and Porphyry are setting out their own positions, the excess is conceived relationally. For any quantities in the ratio X:Y, the 'excess' is the fraction of Y by which X exceeds it (or, in another formulation, it is the ratio between the difference and the smaller term).

⁵⁰³ That is, when the ratio 3:2 is multiplied by the ratio 2:1 to give 6:2=3:1, the ratio of the octave plus a fifth. Porphyry's phrasing might for a moment mislead, but he is obviously not referring to the case in which we double the musical interval (the fifth) which corresponds to the ratio 3:2 (where the appropriate calculation is $3:2 \times 3:2 = 9:4$).

Δέον οὖν ἂν εἴη τὰς τοιαύτας ἀμαρτίας μὴ τῇ δυνάμει τοῦ λόγου προσάπτειν, ἀλλὰ τοῖς μὴ δεόντως αὐτὸν ὑποτιθεμένοις, πειρᾶσθαι δὲ τὸν ἀληθῆ καὶ φυσικώτερον ἐκλαμβάνειν [5]

- Καὶ ταῦτα πρὸς τοὺς Πυθαγορείους ἀποτείνεται μὴ παραιτούμενος μέν, οὓς ἐκ τῶν ἀριθμητικῶν λόγους προσῆψαν ταῖς συμφωνίαις· χρήσεται γὰρ καὶ αὐτὸς αὐτοῖς ὡς ἐνὶ μάλιστα ὑγιεστάτοις οὓσι, τουτέστι τῷ ἐπιτρίτῳ καὶ ἡμιολίῳ καὶ διπλασίῳ καὶ τοῖς λοιποῖς, μὴ προσιέμενος δ' (10) ἐκεῖνα ὅσα ἐκ τῶν συμβεβηκότων αὐτοῖς πειρῶνται κατασκευάζειν, οἷον τὸ δεῖν τὰς συμφωνίας ἐν πολλαπλασίοις λόγοις θεωρεῖσθαι καὶ ἐπιμορίοις, μηκέτι δ' ἐν ἐπιμερέσι, καὶ τὸ δεῖν τοῖς πυθμέσιν ἀριθμοῖς τὰς ἀπλᾶς ἐξετάζεσθαι, καὶ τὸ δεῖν συμφωνοτέρας ἡγεῖσθαι, αἷς ὀλίγα τὰ ἀνόμοια. ταῦτα γὰρ οὐκέτι προσίεται δι' οὐδὲν ἄλλο ἢ ὅτι παραδειχθῇ- (15) σεται τὴν διὰ πασῶν καὶ διὰ τεσσάρων ἀθετεῖν συμφωνίαν, ἣν ἐκεῖνοι μὲν παρητοῦντο, οὗτος δὲ κατεδέξατο. οὔτε γὰρ ἐν ἐπιμορίῳ ἢ πολλαπλασίῳ λόγῳ αὕτη θεωρεῖται, ἀλλ' ἐν ἐπιμερεῖ, οὔτε τὰ ἀνόμοια αὐτῆς ὀλίγα, ἀλλὰ πλεῖστα, ἐξ ὧν ἐκεῖνοι ὡς κανόνων δοκιμάζειν τὰ κατὰ τὰς συμφωνίας ἐπεχείρουν. λοιπὸν δ' ἦν αὐτὸς οἶεται ὑγιεστάτην εἶναι περὶ (20) τούτου διάταξιν, ἐπιφέρει γράφων ταῦτα.

πειρᾶσθαι δὲ τὸν

ἀληθῆ καὶ φυσικώτερον ἐκλαμβάνειν διελομένους τὸ πρῶτον εἰς εἶδη [5]
τρία τοὺς ἀνισοτόνους καὶ διωρισμένους φθόγγους, προηγούμενον μὲν
ἀρετῆς ἕνεκα τὸ τῶν ὁμοφώνων, δεύτερον δὲ τὸ τῶν συμφώνων, τρίτον
δὲ τὸ τῶν ἐμμελῶν. σαφῶς γὰρ διαφέρουσιν ἢ τε διὰ πασῶν καὶ ἡ
δὺς διὰ πασῶν τῶν ἄλλων συμφωνιῶν καθάπερ ἐκεῖνα ἐμμελειῶν, ὡς
οἰκειότερον ἂν ταύτας ὁμοφωνίας κληθῆναι. ὀρίζεσθωσαν δὲ ἡμῖν [10]
ὁμόφωνοι μὲν οἱ κατὰ τὴν σύμψαυσιν ἐνὸς ἀντίληψιν ἐμποιοῦντες ταῖς
ἀκοαῖς, ὡς οἱ διὰ πασῶν καὶ οἱ ἐξ αὐτῶν συντιθέμενοι, σύμφωνοι δὲ
οἱ ἐγγυτάτῳ τῶν ὁμοφώνων, ὡς οἱ διὰ πέντε καὶ οἱ διὰ τεσσάρων καὶ
οἱ ἐξ αὐτῶν καὶ τῶν ὁμοφώνων συντιθέμενοι, ἐμμελεῖς δὲ οἱ ἐγγυτάτῳ
τῶν συμφώνων, ὡς οἱ τονιαῖοι καὶ τῶν τοιούτων οἱ λοιποί. διὸ καὶ [15]
συντίθενται πῶς οἱ μὲν ὁμόφωνοι τοῖς συμφώνοις, οἱ δὲ σύμφωνοι τοῖς
ἐμμελεῖσι.

- (22) Τῶν φθόγγων ἐν τοῖς ἔμπροσθεν ἔθετο τοὺς μὲν εἶναι ἰσοτόνους, τοὺς

in lemma^{prim.}: 15.3 οὓν om. codd.

in lemma^{sec.}: 10 ὁμοφώνους codd.

Chapter 7

| It would not be right to attribute these errors to the power of reason, but to those who ground reason in faulty assumptions, and we should try to grasp reason in its true and more natural form. Ptol. *Harm.* 15.3–5

In directing these criticisms against the Pythagoreans, Ptolemy is not rejecting the ratios of numbers which they assigned to the concords – that is, the epitritic, the hemiolic, the double and the rest – for he uses them himself, as being absolutely the soundest. Nor is he aiming his attacks at | the propositions which they try to construct on the basis of the ratios' properties, such as that the concords must be represented in multiple and epimoric ratios and not in epimerics, that one must assess the simple concords through the foundational numbers, and that one must reckon more concordant those in which the dissimilars are small. He attacks these propositions for no other purpose than to show that | they eliminate the concord of an octave plus a fourth, which the Pythagoreans rejected but he accepted. For it turns out not to be in an epimoric or a multiple ratio but in an epimeric, and its dissimilars are not small but very great – considerations which they used as standards in their attempts to assess matters to do with the concords.⁵⁰⁴

Next, he specifies the arrangement [sc. of the concords] which in his own opinion is the soundest | in this context, writing as follows:

We⁵⁰⁵ should try to grasp reason in its true and more natural form, first distinguishing the unequal-toned and discontinuous notes into three classes. Pre-eminent in excellence is the class of the homophones, second is that of the concords, and third is that of the melodics. For the octave and the double octave plainly differ from the other concords as do the latter from the melodics, so that it would be more appropriate for them to be called 'homophones'. Let us define as homophones those which create for the ear the impression of a single note when they are played together, as do octaves and those that are composed of octaves; as concordant those closest to the homophones, like fifths and fourths and those composed of these plus the homophones; and as melodic those closest to the concords, such as tones and others of that sort. Thus in a way the homophones go together with the concords, and the concords with the melodics. Ptol. *Harm.* 15.4–17

In his earlier statements he laid down that some of the notes are equal toned and some unequal toned. The equal toned are those that do not

⁵⁰⁴ These are shrewd comments. But in fact Ptolemy seems to attack at least one of these propositions (about the use of 'foundational numbers') in its own right; and though the order of excellence he establishes (*Harm.* 15.18–16.21) is indeed consistent with that of these Pythagoreans, he reaches his conclusions by an entirely different method and expresses nothing but contempt for theirs.

⁵⁰⁵ The opening words of this lemma repeat the last words of the preceding one.

- δ' ανισοτόνους· ισοτόνους μὲν τοὺς κατὰ τὴν τάσιν ἀπαραλλάκτους, ανισοτόνους δὲ τοὺς κατὰ τὴν τάσιν παραλλάσσοντας. οἱ μὲν οὖν ισότονοι
- (25) τομὴν οὐκ ἐπιδέχονται, τῶν δ' ανισοτόνων οἱ μὲν ἦσαν συνεχεῖς, οἱ δὲ διωρισμένοι. τοὺς μὲν οὖν συνεχεῖς, ὥσάν τοὺς τόπους τῶν ἐφ' ἑκάτερα μεταβάσεων ἀνεπιδήλους ἔχοντας, παρητήσατο ἀθέτους ὄντας εἰς τὴν τοῦ ἡρμοσμένου παράληψιν· τοὺς δὲ διωρισμένους παραδεξάμενος, φθόγ-
- (113) γους τούτους προσηγόρευσεν. ἦν γὰρ ὁ φθόγγος ψόφος μίαν καὶ τὴν αὐτὴν ἐπέχων τάσιν. αὐτὸς μὲν οὖν καθ' ἑαυτὸν ὁ φθόγγος οὐδέπω ἐθεωρεῖτο ἐν λόγῳ· ἐν δὲ εἶν γὰρ ὁ λόγος πάντως, ἅτ' ὦν τῶν πρὸς τι, καὶ ἐν σχέσει τῇ πρὸς ἀλλήλους τινῶν θεωρούμενος, ἔχων δὲ πρὸς ἄλλον
- (5) σχέσιν ἦτοι πρὸς ισότονον αὐτῷ ἢ πρὸς ανισότονον ἔξει. εἰ μὲν οὖν ισότονον εἶη, ἐν ταυτοτήτι θεωρηθήσεται, εἰ δ' ανισότονον, ἦτοι συνάπτονται ἀλλήλοις καὶ εὐφοροὶ γίνονται πρὸς αἴσθησιν ἢ οὐ συνάπτονται ἀλλήλοις. εἰ μὲν οὖν μὴ συνάπτονται πρὸς ἀλλήλους οἱ φθόγγοι, ἐκμελὴς γίνεται ἡ τοιαύτη σχέσις καὶ αὐτοὶ ἐκμελεῖς οἱ φθόγγοι, εἰ δὲ
- (10) συνάπτοντό πως, ἐμμελεῖς. εἰσὶ γὰρ ἐμμελεῖς, ὅσοι συναπτόμενοι πρὸς ἀλλήλους εὐφοροὶ πρὸς ἀκοὴν τυγχάνουσιν, ἐκμελεῖς δ', ὅσοι μὴ οὕτως ἔχουσιν. τῶν οὖν συναπτομένων καὶ πρὸς ἀκοὴν εὐφόρων τριττὴν ποιεῖται τὴν διαίρεσιν. οἱ μὲν γὰρ οὕτω συνάπτονται, ὥστ' εὐφόρους αὐτοὺς εἶναι πρὸς ἀντίληψιν, οἱ δ' οὕτως, ὥς μὴ μόνον εὐφόρους εἶναι, ἀλλ' ἤδη
- (15) καὶ ὁμοίαν αὐτῶν αἴσθησιν ἀπεργάζεσθαι, οἱ δ' εἰς τοσοῦτον, ὥς καὶ ἐνὸς ποιεῖν ταῖς ἀκοαῖς τὴν ἀντίληψιν, καίπερ ὄντας ανισοτόνους.
- Καλεῖ τοίνυν τοὺς μὲν εὐφόρους μόνον ταῖς ἀκοαῖς ἐμμελεῖς, τοὺς δ' ὁμοιότητος ἤδη μετέχοντας συμφώνους, τοὺς δ' ἐνόητος ὁμοφώνους. εἴ τις μὲν οὖν ἐστιν ὁμόφωνος, καὶ σύμφωνός ἐστι καὶ ἐμμελής πάντως,
- (20) εἴ τις δὲ σύμφωνος, καὶ ἐμμελής πάντως, οὐ πάντως δὲ καὶ ὁμόφωνος. ὁ δ' ἐμμελής οὔτε σύμφωνος πάντως, οὔθ' ὁμόφωνος. καὶ κατὰ τὸ ἀντικείμενον δ' οἱ μὲν ἐκμελεῖς ἐκβεβλήκασιν ταύτης τῆς διαιρέσεως, οἱ δὲ διάφωνοι οὐ πάντως εἰσὶ καὶ ἐκμελεῖς· οἱ γὰρ ἐμμελεῖς μόνον ὄντες,

23 τοὺς] οἱ typographico errore Düring 25 τομὴν] τὸ μὲν pV¹⁸⁷

12 τρίτην V¹⁸⁷ 14 πρὸς – εἶναι om. p 17 καλεῖται p 23 ἐμμελεῖς scripsi ἐκμελεῖς typographico errore Düring

change in pitch, and the unequal toned are those that do change in pitch. The equal toned, therefore, | do not admit division; but of the unequal toned some were said to be continuous and others discontinuous.⁵⁰⁶ Now since the locations at which the continuous notes shift in either direction are not clearly discernible, he rejects them as inadmissible into the usage of attunement. But he accepts the discontinuous, and they are what he calls 'notes'.⁵⁰⁷ For a note was said to be a sound which maintains one and the same pitch. In itself alone, therefore, a note can never be in a ratio, for a ratio is always in two things, since it is relational, and is found in the relation of certain things to one another; and since it involves a relation with something else, the relation will be either | with a note equal to it in tone or with one that is unequal in tone. If then it is equal in tone, the ratio will consist in sameness; and if it is unequal in tone, either the two are connected with one another and are agreeable to perception, or they are not connected with one another. Then if the notes are not connected with one another, the relation is unmelodic and the notes themselves are unmelodic too, but if they | are connected in some way they are melodic. For melodic notes are those which when connected with one another are agreeable to the hearing, and unmelodic notes are those which are not like that.⁵⁰⁸ Ptolemy then makes a three-part division of those that are connected and agreeable to the hearing. Some are connected in such a way that they are agreeable to perception; some in such a way that they are not only agreeable but also | produce a homogenous impression of themselves on perception; and some do so to such an extent that they make the impression of one note on the hearing, even though they are unequal toned.

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He calls those that are only agreeable to the hearing 'melodic', those that also have homogeneity 'concordant', and those that have unity 'homophonous'. Then if some note is homophonous it is always also both concordant and melodic; | if a note is concordant it is always also melodic but not always also homophonous; and a melodic note is not always either concordant or homophonous.⁵⁰⁹ Conversely, unmelodic notes have been expelled from the division, but discordant notes are not always unmelodic;

⁵⁰⁶ For Porphyry's main discussion of this distinction see 83.1–87.19 above.

⁵⁰⁷ Hence the references to 'continuous notes' in the preceding lines are inappropriate; they are merely continuous sounds.

⁵⁰⁸ Porphyry does not define the notion of 'connectedness' in play here. What he probably means is that two notes are 'connected' if they can both occur in the same (unmodulated) scale or melody.

⁵⁰⁹ A single note taken alone cannot have any of these attributes; Porphyry is referring to a note standing at some interval from another. Even so, his remarks do not precisely reflect Ptolemy's usage, or that of most other Greek theorists. They reserve the term 'melodic' (*emmelēs*) for intervals in a well-formed scale that are neither concordant nor homophonous, and almost always for intervals between adjacent notes of the scale.

- (25) οὔτε σύμφωνοι οὐθ' ὁμόφωνοι ὑπάρχοντες, διάφωνοι μὲν εἰσιν, οὐ μὴν καὶ ἐκμελεῖς ἔστωσαν. οἱ μὲν ἐκμελεῖς πάντως καὶ διάφωνοι, οἱ δὲ διάφωνοι οὐ πάντως καὶ ἐκμελεῖς.

- Πάντως δὲ ταύτης τῆς διαιρέσεως οἱ πλείους τῇ μὲν τῶν ἐμμελῶν καὶ συμφώνων κέχρηται διαφορᾷ, τῇ δὲ τῶν ἐν τοῖς ἀνισοτόνοις ὁμοφώνων οὐκέτι. οἱ γὰρ παλαιοὶ τοὺς ἰσοτόνους ἀδιαφόρως τ' ἰσοτόνους καὶ ὁμοφώνους ἐκάλουν· οὗτος δὲ διέκρινε τὸ ὁμόφωνον τοῦ ἰσοτόνου, καὶ τὸ μὲν ἰσότονον ἐν τοῖς κατ' ἴσων τάσεων θεωρουμένοις ἔταξε, τὸ δ' ὁμόφωνον ἐν τοῖς μὴ κατὰ τὴν αὐτὴν μὲν τάσιν θεωρουμένοις καὶ διὰ τοῦτο διαφέρουσι κατ' ὀξύτητα τε καὶ βαρύτητα, κατὰ δὲ τὴν σύγκρουσιν ἀντίληψιν ἐνὸς ταῖς ἀκοαῖς παρεχομένοις. τοὺς δὲ τοιοῦτους συμφώνους
- (II4) συμφώνους οἱ παλαιοὶ ἐκάλουν ἀποδεδωκότες τὸ ὁμόφωνον τῷ ἰσοτόνῳ. διελὼν οὖν αὐτὸς τὰ παρὰ τοῖς παλαιοῖς λεγόμενα σύμφωνα, τοῦτων τὰ μὲν καλεῖ σύμφωνα, τὰ δ' ὁμόφωνα διαφερόντως κατὰ τοῦτο ἐκείνοις περὶ τὴν προσηγορίαν ἰστάμενος. ὅσα μέντοι κἀκεῖνοι ἐμμελῆ ἄλλ' οὐ
- (5) σύμφωνα προσηγόρευον, ταῦτα καὶ οὗτος ὁμοίως κέκληκεν. τὰ μὲν οὖν ὁμόφωνα ὅτι ἐπὶ τῶν ἰσοτόνων ἔλαττον διαφοροῦντα περὶ τὴν κλῆσιν ἐκατέραν, δηλοῖ τὸ τῆς Κυρηναίας Πτολεμαΐδος καὶ ἄλλων πλειόνων, οἱ τὴν μὲν ὁμοφωνίαν διὰ τῆς ἰσοτονίας ἀπεδίδουσιν, τὴν δ' ἰσοτονίαν διὰ τῆς ὁμοφωνίας. ὁμοφωνία γὰρ ἐστὶ κατ' αὐτοὺς ἰσοτονία φθόγγων, καὶ
- (IO) ὁμόφωνοι φθόγγοι, ὧν αἱ τάσεις θεωροῦνται ἐν ταυτότητι· ἰσοτονία δέ, ὅταν δύο φθόγγοι ὅμοιοι τῇ τάσει ἅμα κρουόμενοι ἀπαράλλακτον ἔχωσι τὴν διαφοράν, ἰσοδυναμοῦσι δ' οἱ ὅροι· εἰσὶ γὰρ τοῦ αὐτοῦ καὶ ἐνός. ὁ μέντοι Πτολεμαῖος διέκρινε—συνεκύρωσε γάρ—ἐν τοῖς τῆς φύσεως ἔργοις ὄντων φθόγγων τῶν μὲν ὀξέων, τῶν δὲ βαρέων, καὶ πάλιν τῶν

29 ἀδιαφόρως Wallis διαφόρους G διαφόρος ceteri 31 κατ' ἴσων τάσεων] κατ' ἴσων τάσιν Alexanderson

4 ἐμμελῆ Wallis ἐκμελῆ codd. 6 ἔλαττον διαφοροῦντα Wallis ἔλαβον ἀδιαφοροῦντες Alexanderson ἐλάττονα διαφοροῦντα g ἐλάττονα διαφοροῦντα ceteri 12 ἰσοδυναμοῦσι Wallis ἰσοδυναμῶσι Düring

for those that are only melodic, and neither concordant nor homophonous, are indeed discordant, but should not | be thought of as unmelodic too.⁵¹⁰

Most people have used this division's distinction between melodic and concordant notes, but not the one picking out the unequal-toned notes that are homophonous. For the ancient writers called equal-toned notes indifferently 'equal toned' or | 'homophonous'.⁵¹¹ But Ptolemy distinguishes the homophonous from the equal toned, assigning 'equal toned' to those with equal pitches, and 'homophonous' to those which do not have the same pitch and so differ in height and depth, but which when played simultaneously produce the impression of one note on the hearing. Notes that are concordant in this way were called 'concordant' by the ancient writers, and they gave the name 'homophonous' to the equal toned.⁵¹² Ptolemy thus divides up those that the ancient writers called 'concordant'; he calls some of them 'concordant' but others 'homophonous', and in this way differs from them in his use of the term. The ones that they called 'melodic' but not | 'concordant', however, he too has designated in the same way.

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The fact that there used to be less difference between the uses of the terms 'homophonous' and 'equal toned' is shown by the work of Ptolemaios of Cyrene and many others, who explained homophony by reference to equality of tone and equality of tone by reference to homophony. For according to them, homophony is equality of tone between notes, and | homophonous notes are those whose pitches are the same; while equality of tone occurs when two notes with the same pitch, played simultaneously, are distinct without being different;⁵¹³ and the definitions are equivalent to one another for they are of one and the same thing. Ptolemy, however discerned – for he laid it down as true⁵¹⁴ – that given the existence among

⁵¹⁰ Literally 'but let them not be also unmelodic'.

⁵¹¹ That is, they used the term 'homophonous' only of unisons, as indeed they did. Ptolemy's usage is exceptional.

⁵¹² Düring's text has the word *sympḥōnous* twice in succession at 113.34–114.1, which looks like an error, but can be intelligibly construed in the way conveyed by my translation. If one instance were deleted the sense would be 'Notes of this sort were called "concordant" . . .'

⁵¹³ Literally 'have the difference unchanged', or 'have difference involving no difference'. I take Porphyry to mean that in the relevant respect (i.e. in pitch) they are identical, but they remain distinct items. Since the notes are described as 'played simultaneously', Porphyry (or his source) is probably thinking of cases where a note in a melody coincides with that of its accompaniment. The definition of 'homophonous', by contrast, does not require that the two notes are played at the same time, and here the reference may be to instances in which two notes have the same pitch, but belong to two different keys (*tonoi*) or to different forms of the scale, and so have different melodic functions and different names. Alternatively and more simply, it may be to just any two examples of a note at a given pitch.

⁵¹⁴ The verb *synkyroein* is rare. It occurs occasionally in contexts concerned with laws, where it means 'to decree'. If the MSS reading is correct (which may be doubted), I take Porphyry to mean that Ptolemy authoritatively asserted it (and perhaps also that he had good reasons for doing so; cf. the sense recorded by the lexicographer Hesychius, 'to confirm', or 'to establish').

- (15) βαρέων τῶν μὲν ὄντων ἀλλήλοις ὁμοίων, τῶν δ' ἀνομοίων, εἶναι τινὰς τῶν ὀξέων καὶ βαρέων—καίπερ ὄντων ἐναντίων—ὁμοίους κατ' ἀντίληψιν ἐκείνοις. διὸ τῶν μὲν βαρέων τοὺς ὁμοίους καὶ ἀπαραλλάκτους, ἰσοτόνους καλεῖν ἤξιωσεν, ὅτι ἡ τάσις κοινὸν τι ἦν ὀξύτητος τε καὶ βαρύτητος· τῶν δὲ βαρέων καὶ ὀξέων—καὶ οὕτως ἐναντίων—τοὺς κίρναμένους καὶ ἀδιαφοροῦντας ἑνὸς ὁμοφώνους· τούτοις μὲν διδοὺς τὸ τῆς ὁμοφωνίας, ἐκείνοις δὲ τὸ τῆς ἰσοτονίας.
- (20)

Τούτων δὴ προδιωρισμένων μετιτέον ἐπὶ τὸν ἀκόλουθον αὐτοῖς λόγον, ἀρχὴν λαβοῦσι τὴν αὐτὴν τοῖς Πυθαγορείοις, τουτέστι καθ' ἣν τοὺς μὲν ἴσους ἀριθμοὺς τοῖς ἰσοτόνοις φθόγγοις ἀπονέμεμεν, τοὺς [20] δὲ ἀνίσους τοῖς ἀνισοτόνοις, ὅτι τὸ τοιοῦτον αὐτόθεν ἐστὶ δῆλον.

- (23) Τῆς διαιρέσεως τῶν πρὸς ἄλληλα σχέσιν ἔχόντων φθόγγων τοιαύτης γενομένης καὶ τοῖς ἐκ τῆς αἰσθήσεως κρίσιν ἔχουσι προσαρμοστέον φησὶ
- (25) καὶ τὴν παλαιὰν τοῦ λόγου ἀκρίβειαν ταῖς ἀπὸ τῆς αἰσθήσεως δοθείσαις διαφοραῖς. ἔνθα καὶ τὰ περὶ τῶν Πυθαγορείων παραληπτέον ὡς ἱκανῶς τὸ ἀκριβὲς ἔχοντα, καὶ ἀρκτέον γε καθάπερ ἐκεῖνοι ἄνωθεν ἀπὸ τῆς ἰσότητος τῶν ἀριθμῶν, ἣν δὴ ἀποδοτέον καὶ τὸν λόγον τὸν κατ' αὐτὴν προσαρμοστέον τοῖς ἰσοτόνοις. ἐκείνων μὲν οὖν οἱ πλείους οὐ μόνον ἀπὸ τῆς
- (115) ἰσότητος ἤρχοντο, ἀλλὰ καὶ ἀπὸ τοῦ πυθμένος ἀριθμοῦ. τῆς ἰσότητος δ' ἀπλῶς τοὺς ἴσους ἀριθμοὺς ἀποδοτέον φησὶ τοῖς ἰσοτόνοις φθόγγοις, τοὺς δ' ἀνίσους τοῖς ἀνισοτόνοις. ὅτι γὰρ διὰ τῶν πυθμένων τὰ κατὰ τὰς συμφωνίας ἀπεδείκνυσαν, δηλοῖ Εὐδημος ἐν τῷ πρώτῳ τῆς

16 καὶ βαρέων del. Alexanderson ὁμοίως pV¹⁸⁷ 17 post μὲν add. <ὀξέων καὶ> Alexander-
son 18 τάσις] τάσις p 19 ἐναντίον pV¹⁸⁷ 23 τῆς διαιρέσεως Düring τῶν διαιρέσεων codd.
24 καὶ τοῖς] καίτοι p 25 τὴν παλαιάν] τὴν τῶν παλαιῶν fortasse legendum 28 ἣν] ἣν Mullach
in lemmate: 15.18 ἐπὶ] πρὸς codd. 21 αὐτόθι δῆλον ἐστὶν codd.

the works of nature of some notes that are high and others that are low, and given that | some of the low notes are similar to one another and others dissimilar, some of the high and low notes, although they are opposites, are similar to the others in the impression they make.⁵¹⁵ Hence he thought it right to call ‘equal toned’ those of the low notes that are similar and do not differ, since pitch is common to both height and depth,⁵¹⁶ and to call ‘homophonous’ those of the low and the high – and therefore opposite – notes that are mingled | and do not differ from one, assigning homophony to the latter and equality of tone to the former.

Given these preliminary distinctions, we must move on to the reasoning that follows from them, adopting the same initial principle as the Pythagoreans – that is, the principle according to which we assign equal numbers to equal-toned notes and unequal numbers to unequal-toned notes – since such things are self-evident. Ptol. *Harm.* 15.18–21

Now that this division of notes in relation to one another has been made, Ptolemy says that for those things that can be judged by sense-perception we should also bring | the ancient accuracy of reason⁵¹⁷ to bear on the differences that perception announces. Hence one should adopt the theses of the Pythagoreans as sufficiently accurate, and one should begin, as they do, from the highest level, from equality of numbers, which, with the ratio belonging to it, one should assign to equal-toned notes. Now most of them began not only from equal-toned notes, but also from the foundational number. But Ptolemy says simply that one should assign equal numbers to equal-toned notes, and unequal numbers to unequal-toned notes. The

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⁵¹⁵ That is, some of the high notes strike our ears as similar to some of the low notes, and conversely.

⁵¹⁶ Porphyry probably inserts this clause to remind us that the element *tonos* in the word *isotonos*, ‘equal toned’, has the same meaning as *tasis*, ‘pitch’; cf. 82.6–14 above. It is odd that in the previous clause he refers only to low notes; plainly the same is true of high notes too. The omission could be repaired if we adopted Alexanderson’s supplement at 114.17, but since the same peculiarity appears two lines earlier as well, we would either have to add a similar supplement at 114.15 or to accept also his addition to the text of 114.16. But since the same apparent omission occurs twice in a passage in which high and low notes are repeatedly mentioned together, I think we should accept that the difference in these cases is deliberate, and I am reluctant to interfere with the MSS text, though I cannot satisfactorily explain it.

⁵¹⁷ This is an odd phrase; I translate it literally. It may be what Porphyry wrote, or perhaps at 114.25 *palaian* (‘ancient’) should be emended to *tōn palaion* (‘of the ancient writers’). In either case, as the sequel shows, he must mean ‘the accuracy which the ancient writers achieved through reason’. The verb that I translate as ‘bring . . . to bear’ is *prosarmozein*, literally ‘to attach’ or ‘adapt’ one thing to another. It is not in regular use as a term of musical theory, but in musical contexts inevitably suggests ‘attuning’ one instrument to another. The meaning is of course not that reason must be ‘tuned’ in such a way that it assents to whatever sense-perception indicates; its task is to provide its own expression of the phenomenon that sense-perception records, singing as it were the same note but in a different language.

- (5) Ἀριθμητικῆς ἱστορίας, λέγων περὶ τῶν Πυθαγορείων ταυτὶ κατὰ λέξιν.

“Ἐτι δὲ τοὺς τῶν τριῶν συμφωνιῶν λόγους τοῦ τε διὰ τεσσάρων καὶ τοῦ διὰ πέντε καὶ τοῦ διὰ πασῶν ὅτι συμβέβηκεν ἐν πρώτοις ὑπάρχειν τοῖς ἐννέα· β’ γὰρ καὶ γ’ καὶ δ’ γίνεται ἐννέα.”

- (10) Αἰτίαν δ’ ὁ Πτολεμαῖος τοῦ δεῖν τοὺς ἴσους ἀριθμοὺς ἀπονέμειν τοῖς ἰσοτόνοις ἀποδίδωσι τὴν αὐτόθι τοῦ λόγου ἐνάργειαν. ἐξῆς δ’ ἐπάγει.

ἀκολουθου τοῖνυν ὄντος τῇ ἀρχῇ τοῦ καὶ τὰς ἐκκειμένας τῶν ἀνισοτόνων φθόγγων διαφορὰς τῇ πρὸς τὰς ἰσότητος ἐγγύτητι παραμετρεῖσθαι, φανερόν ἐστιν εὐθύς, ὅτι τῇ ἰσότητι ταύτῃ μὲν ἐστὶν ὁ διπλάσιος λόγος ἐγγυτάτω τὴν ὑπεροχὴν ἴσῃν ἔχων καὶ τὴν αὐτὴν τῷ ὑπερεχομένῳ, [25] τῶν δὲ ὁμοφώνων ἐνωτικώτατον καὶ κάλλιστον τὸ διὰ πασῶν, ὥστε τούτῳ μὲν ἐφαρμόζειν τὸν διπλάσιον λόγον, τῷ δὲ δις διὰ πασῶν δηλονότι τὸν δις διπλάσιον, τουτέστι τὸν τετραπλάσιον, κἂν εἴ τινες ἔτι μετροῖντο τῷ τε διὰ πασῶν καὶ τῷ διπλασίῳ.

Ἀποδοθέντος τοῦ τῆς ἰσότητος λόγου, ὃς ἐπ’ ἴσων ἀριθμῶν ἔθεωρεῖτο, τοῖς ἰσοτόνοις, τῶν δ’ ἀνίσων τοῖς ἀνισοτόνοις, [παραμετρητέον] ἀρχῶν

- (15) κειμένων ἐν μὲν φθόγγοις τοῦ ἰσοτόνου, ἐν δ’ ἀριθμοῖς τῆς ἰσότητος, λοιπὸν ἐπὶ τῶν ἀνισοτόνων φθόγγων καὶ τῶν ἀνίσων λόγων τοῖς ἐγγύς καθ’ ἑκάτερον τῆς οἰκείας ἀρχῆς καὶ ἀπὸ τῆς ἐγγύτητος ἢ τοῦ πόρρω

8 ὑπάρχει p 11 ἐνέργειαν p 14 [παραμετρητέον] seclusi

in lemmate: 15.25 ἔχων ἴσῃν codd. 28–9 κἂν εἴ τινες μετροῖτ’ ἂν codd.

fact that they demonstrated things to do with the concords through the foundational numbers is shown by Eudemus in the first book of his | *History of Arithmetic*, who writes as follows about the Pythagoreans, in these words: '<They said> that the ratios of the three concords, the fourth, the fifth and the octave, turn out in the first <numbers> to be contained in the <number> 9; for 2 and 3 and 4 make 9.'⁵¹⁸

| Ptolemy says that basis for requiring that equal numbers should be assigned to equal-toned notes is the clear and self-evident testimony of reason. He continues as follows.

Then since it is in accordance with this principle that we should comparatively measure the specified differences between unequal-toned notes by their closeness to the equalities, it is at once clear that the double ratio is closest to this equality, since it has an excess equal to and the same as the number that is exceeded;⁵¹⁹ and among the homophones the most unitary and finest is the octave, so that we should fit to it the double ratio; and to the double octave we should obviously assign the doubled double ratio, that is, the quadruple, and so on for any others that are measured by the octave and the double ratio. Ptol. *Harm.* 15.22–9

Now that the ratio of equality, which was found in equal numbers, has been assigned to equal-toned notes and unequal numbers to unequal-toned notes, their origins | being the equal toned in the case of notes and equality in the case of numbers, the next point is that unequal-toned notes and unequal ratios should be comparatively measured by how close they are, in either direction, to their proper starting-point, and the differences between unequals on the basis of their closeness <to equality> or their distance <from it>.⁵²⁰ It is clear, he says, that among the ratios represented in

⁵¹⁸ Eudemus of Rhodes fr. 142 Wehrli; cf. Zhmud (2006): 214–18. (But Eudemus is one of the heroes of Zhmud's book; see his index for further references.) My translation assumes the explanation which I offer below; an alternative would be '... turn out to be contained in the first nine <numbers>'. This representation of the numbers is unusual; more commonly the numbers involved in the ratios of concords are said to be 1, 2, 3 and 4, four numbers adding up to 10, the famous 'tetraktys of the decad'. In the version that Eudemus attributes to the Pythagoreans the ratio of the octave is apparently represented as 4:2 rather than 2:1, since the numbers he gives do not include the unit, 1. Hence the octave ratio is not expressed in its lowest terms. But this treatment might be justified by the fact that for Greek mathematicians the unit is not a 'number', *arithmos*, since the word *arithmos* designates a plurality, and hence the unit cannot appear among the 'first numbers' (see Eucl. *El.* VII defs. 1–2). Note, however, that *arithmoi* are not explicitly mentioned in the quotation. The scheme reappears (with an allusion to *arithmoi*) at Arist. Quint. 102.16–19; for the type in which the sum of the terms is 10 see e.g. Adrastus *apud*. Theo Smyrn. 58–9, Sext. Emp. *Adv. math.* 7.94–5.

⁵¹⁹ That is, the difference between the terms is equal to the smaller term.

⁵²⁰ The Greek of this sentence (or sentences) is very difficult. I am by no means certain that I have emended, punctuated and translated it correctly, and I commend it to the attention of scholars with greater powers of linguistic discernment.

- παραμετρητέον τὰς τῶν ἀνίσων διαφοράς. φανερόν φησιν ὅτι τῆς ἰσότη-
 (20) τος ἐγγυτάτω τέτακται ἐν μὲν λόγοις τοῖς θεωρουμένοις ἀριθμοῖς ὁ
 διπλασίος, ἐν δὲ φθόγοις τὸ διὰ πασῶν ὁμόφωνον. ὅτι μὲν οὖν τὸ διὰ
 πασῶν ἐγγύς τοῦ ἰσοτόνου, μαρτυρεῖ ἡ αἴσθησις· ὅτι δὲ τὸ διπλάσιον
 ἐγγύς τῆς ἰσότητος, δείκνυσιν ὁ λόγος. μόνος γὰρ ὁ διπλάσιος λόγος
 τὴν ὑπεροχὴν ἴσην ἔχει τῷ ὑπερεχομένῳ καὶ τὴν αὐτήν. πολλὰ δὲ καὶ
 (25) ἡμῖν περὶ τούτου εἴρηται πρότερον. ὥστ' ἀποδοτέον τῇ διὰ πασῶν, ὅτι
 τῶν ὁμοφώνων ἐνωτικώτατόν τε καὶ κάλλιστον τὸ διὰ πασῶν, τοῦ δὲ
 διπλασίου τῇ διὰ πασῶν ἀποδοθέντος τῇ δις διὰ πασῶν ἀπονεμοῦμεν τὸ
 δις διπλάσιον· δις δὲ διπλάσιος λόγος ἐστὶν ὁ τετραπλάσιος. εἰ δὲ καὶ
 τρις διὰ πασῶν ἐστιν, ὥς τινες παρεδέξαντο, ἢ καὶ τετράκις, ὡς Πλά-
 (30) των ἐν τῇ Ψυχογονίᾳ τοῦ παντός, ἄχρι τοῦ τετράκις διὰ
 πασῶν καὶ διὰ πέντε καὶ τόνου προσαγαγῶν τὸ διάστημα, δι' αἷς ἐν ἄλ-
 (116) λοις ἀποδιδόμεν αἰτίας, μετροῖτ' ἂν καὶ ταῦτα τὰ σύμφωνα τῷ τε διὰ
 πασῶν καὶ τῷ διπλασίῳ. ὑποκείσθω γὰρ ἡ τρις διὰ πασῶν· οὐκοῦν
 τῆς μὲν διὰ πασῶν ἦσαν ἀριθμοί, ὡς τὰ δύο πρὸς τὸ ἓν, τῆς δὲ δις διὰ
 (5) πασῶν, ὡς τέσσαρα πρὸς τὸ ἓν. προστεθείσης οὖν τῆς διὰ πασῶν τῇ
 δις διὰ πασῶν διπλασίονα ἀριθμὸν ληψόμεθα τοῦ τέσσαρα· οὗτος δ'
 ἐστὶν ὁ ἡ' πρὸς τὸ ἓν· λέγω δὲ τῷ ὀκταπλασίῳ. εἰ δ' εἴη καὶ τετρά-
 (10) κισ διὰ πασῶν, ληψόμεθα καὶ τοῦ ὀκτῷ διπλάσιον τὸν ις', καὶ γίνεται ἐν
 λόγῳ τῷ ἑκκαίδεκαπλασίῳ μετρουμένῳ τῇ τρις διὰ πασῶν καὶ τῇ διὰ
 πασῶν. αὖξιν μὲν οὖν ἀριθμούς τε καὶ λόγους ἔνεστιν ἐπὶ πλεῖστον.
 (10) δυνάμει δὲ τοσοῦτον διάστημα διαστήναι δυνάμενον, ἀδύνατον ἐντυχεῖν
 ἀνθρώπῳ. περὶ μὲν οὖν τῶν ὁμοφώνων εἰρήσθω ταῦτα.

πάλιν μετὰ μὲν τοὺς διπλα-

σίους λόγους γίνονται' ἂν ἐγγυτέρω τῆς ἰσότητος οἱ δίχα τοῦτον ἐγγιστα [30]
 [16] διαιροῦντες, τουτέστιν ὃ τε ἡμιόλιος καὶ ὁ ἐπίτριτος. τὸ γὰρ δίχα ἐγγι-
 στα πλησίον ἐστὶ τοῦ εἰς δύο ἴσα. μετὰ δὲ τοὺς ὁμοφώνους πρῶτοι
 μὲν τῶν συμφώνων οἱ τὸ διὰ πασῶν δίχα ἐγγιστα διαιροῦντες, τουτέ-
 στιν ὃ τε διὰ πέντε καὶ ὁ διὰ τεσσάρων, ὥστε τὸν μὲν διὰ πέντε κατὰ τὸν
 ἡμιόλιον πάλιν τίθεσθαι λόγον, τὸν δὲ διὰ τεσσάρων κατὰ τὸν ἐπίτρι- [5]
 τον, δεῦτεροι δὲ οἱ κατὰ σύνθεσιν ἐκατέρου τῶν πρῶτων μετὰ τοῦ
 πρώτου τῶν ὁμοφώνων, ὁ μὲν διὰ πασῶν καὶ διὰ πέντε κατὰ τὸν συν-
 τίθεμενον λόγον ἐκ τοῦ διπλασίου καὶ ἡμιολίου, τὸν τριπλάσιον, ὁ δὲ

2 οὐκοῦν — 4 πασῶν ^{prim.} om. V¹⁸⁷ 3 τῆς — 4 ἐν om. G 11 ὁμοφονούντων g
 in lemmate: 15.30 γίνοιτ' p τούτους p

numbers the one placed closest to equality is the | double, and among notes it is the homophone of the octave.

Now it is perception that testifies that the octave is close to the equal toned, but it is reason that shows that the double is close to equality. For it is only the double ratio that has an excess equal to and the same as that which is exceeded.⁵²¹ We have already said a good deal about that. Hence it must be assigned to the octave, since | the octave is the most unified and most beautiful of all the homophones; once the double has been assigned to the octave, we shall allot the twice-double to the double octave, and twice the double ratio is the quadruple. And if there is also a triple octave, as some people accepted,⁵²² or a quadruple, as Plato says in his *Generation of the World-Soul*⁵²³ (extending the interval | to a quadruple octave plus a fifth plus a tone, for reasons we explain elsewhere⁵²⁴), these concords too will be measured by the octave and the double ratio. For let there be a triple octave. The numbers belonging to the octave were as 2 to 1, and those of the double octave were as 4 to 1. Then when an octave is added to the | double octave we shall take the number which is the double of 4, giving 8 to 1, by which I mean the octuple. And if there were also a quadruple octave, we shall take the double of 8, that is, 16; and it is in the sixteen-fold ratio, measured by the triple octave and the octave. It is thus possible to increase numbers and ratios very greatly; | but while so large an interval can potentially open up, it is impossible for a human being to encounter it. Let this, then, be our account of the homophones.

[116D]

Again, after the duple ratios, the nearer to equality are those that most nearly divide that one in half, that is, the hemiolic [3:2] and the epitritic [4:3]. For what divides most nearly into halves approximates to dividing into two equals. After the homophones the first of the concords are those that divide the octave most nearly into halves, that is, the fifth and the fourth, so that we can again posit that the fifth is in hemiolic ratio and the fourth in epitritic; and second are those formed by putting each of the first concords with the first of the homophones, the octave and a fifth in the ratio put together from

⁵²¹ Here the 'excess' (*hyperochē*) is simply the quantitative difference between the two terms.

⁵²² These are presumably the Aristoxenian theorists who added two new *tonoi* (keys) to Aristoxenus' system of 13, which were spaced at intervals of a semitone (e.g. Arist. Quint. 20.5–9). In this new scheme there were therefore 15 keys, spaced out at intervals of a semitone; and in order to accommodate a two-octave scale in each of them, the system as a whole had to be extended to a little over three octaves.

⁵²³ I.e. *Timaus* 35b–36a.

⁵²⁴ Presumably in his writings on the *Timaus*, of which only fragments now survive, though not necessarily in a 'commentary', in the technical sense of that word. As an anonymous reader points out, the work may have been a self-contained essay, designed as a contribution to the repertoire of literature on the World Soul.

διὰ πασῶν καὶ διὰ τεσσάρων κατὰ τὸν συντιθέμενον λόγον ἐκ τοῦ διπλασίου καὶ ἐπιτρίτου, τὸν τῶν ὀκτῶ πρὸς τὰ τρία. νῦν γὰρ οὐδὲν ἡμᾶς [10] οὗτος οὐκ ὦν ἐπιμόριος ἢ πολλαπλάσιος δυσωπήσει μηδὲν γε τοιοῦτο προϋποτεθειμένους.

- (13) Μετὰ τὸν διπλάσιον τῶν ἐπιμορίων ἐγγὺς ἂν εἶεν τῆς ἀρχῆς φησιν—
ἥπερ ἦν ἰσότης—οἱ τὸν διπλάσιον ἔγγιστα πως εἰς ἴσα διαιροῦντες.
- (15) διελεῖν μὲν γὰρ αὐτὸν εἰς ἴσα οὐχ οἷόν τ' ἦν ὄντα τῶν ἀνίσων, ἀλλ' οὐ
τῆς ἰσότητος. οἱ δ' ἔγγιστα δίχα διαιροῦντες ἔγγιστ' ἂν εἶεν τῆς ἰσότη-
τος. ἐγγὺς δ' εἰς ἴσα διαιροῦσι τὸν διπλάσιον ὃ τε ἡμιόλιος καὶ ὁ ἐπί-
τριτος· οὐ γὰρ πολλὴ ἡ ὑπεροχὴ τοῦ ἡμιολίου [ἦ] τοῦ ἐπιτρίτου ἢ ὑπε-
ροχὴ οὕσα ἐπογδοος. τὸ δ' ἔγγιστα δίχα πλησίον ἐστὶ τοῦ εἰς δύο ἴσα.
- (20) τῶν οὖν λόγων τοιαύτην ἐχόντων τάξιν μεταβατέον ἐπὶ τοὺς φθόγγους.
ἦσαν δὲ μετὰ τοὺς ὁμοφώνους οἱ σύμφωνοι ἐγγὺς τῆς ἀρχῆς, ὧν πρῶτοι
οἱ ἔγγιστα τὴν διὰ πασῶν δίχα διαιροῦντες. εἰς δ' οὗτοι οἱ διὰ πέντε
καὶ οἱ διὰ τεσσάρων καὶ μείζων ὁ διὰ πέντε τοῦ διὰ τεσσάρων τόνω.
ἀποδοτέον ἄρα καὶ τῶν ἔγγιστα διαιρούντων τὸν διπλάσιον λόγον τὸν
- (25) μὲν ἡμιόλιον μείζονα ὄντα τοῦ ἐπιτρίτου ἐπογδῶ τῷ διὰ πέντε, τὸν δ'
ἐπίτριτον ἐλάττονα ὄντα τοῦ ἡμιολίου ἐπογδῶ λόγῳ τῷ διὰ τεσσάρων.
πρῶτοι μὲν οὖν λόγοι ἐπιμορίων τε καὶ συμφώνων φθόγγων οὗτοι. δεύτε-
ροι δὲ τῶν συμφώνων ἦσαν οἱ ἐκ τῶν εἰρημένων τούτων συμφώνων τοῦ
διὰ πέντε καὶ τοῦ διὰ τεσσάρων καὶ τῶν ὁμοφώνων συντεθέντες καὶ ἀπο-
- (30) τελεσθέντες τό τε διὰ πέντε καὶ διὰ πασῶν σύμφωνον καὶ πάλιν τό τε
διὰ τεσσάρων καὶ διὰ πασῶν σύμφωνον, κἂν πλείους εἶεν οἱ ὁμόφωνοι
τούτοις συντιθέμενοι.
- (117) Παραβαλέσθωσαν τοίνυν οἱ τῷ διὰ πασῶν συντιθέμενοι τοῖς ἐκ τοῦ
διπλασίου καὶ τῶν ἔγγιστα διαιρούντων αὐτὸν συντιθεμένοις λόγοις. τὸ
μὲν οὖν διὰ πασῶν καὶ διὰ πέντε σύμφωνον παραβληθῆσεται τῷ τριπλα-
σίῳ λόγῳ· τοῦτον γὰρ ὑφίστησιν ὁ ἡμιόλιος, ὁ γ' καὶ ὁ β'· καὶ προσει-
- (5) λήφθω διπλάσιος τοῦ γ', ὁ δ' ζ'. οἱ ἄρα ἄκροι ζ' καὶ β' ἐν τριπλασίῳ λόγῳ
ἔσσονται συγκείμενοι ἐκ τοῦ διπλασίου καὶ ἡμιολίου. κἂν προτάξης δὲ

the duple and the hemiolic, which is the triple, and the octave and a fourth in the ratio put together from the duple and the epitritic, which is that of 8 to 3. For the fact that this ratio is neither epimoric nor multiple will now be no embarrassment to us, since we have adopted no preliminary postulate of that sort. Ptol. *Harm.* 15.29–16.12

He says that after the double, those of the epimorics will be close to the origin – which was agreed to be equality – which most nearly divide the double into equal parts. | For to divide it into equals is not possible, belonging as it does to the class of unequals and not of equality;⁵²⁵ but those that divide it most nearly in half will be the closest to equality. The hemiolic and the epitritic ratios divide the double into nearly equal parts, for the excess of the hemiolic over the epitritic is not great, since it is epogdoic [9:8]; and that which divides most nearly in half is close to dividing into two equals.

| Given, then, that the ratios are ordered in this way, we must transfer our attention to the notes. It was agreed that after the homophones, the concordant are close to the origin; and first among them are those that divide the octave most nearly in half. These are the fifth and the fourth, and the fifth is greater than the fourth by a tone. Then of the ratios that most nearly divide the double ratio <in half>, one should assign to | the fifth the hemiolic ratio, which is greater than the epitritic by an epogdoic, and one should assign to the fourth the epitritic ratio, which is smaller by an epogdoic than the hemiolic. These, then, are the first ratios of the epimorics and of the concordant notes.

Second among the concords are those composed of the concords we have mentioned, the fifth and the fourth, put together with the homophones, producing | the concord of the octave and a fifth, and also that of the octave and a fourth, even if several homophones are put together with them. Those put together with the octave should then be correlated with the ratios put together from the double and those that most nearly divide it <in half>. Then the concord of the octave and a fifth will be correlated with the triple ratio. For the basis of it is the hemiolic,⁵²⁶ 3 and 2; and let there be taken in addition | the double of 3, which is 6. Then the extreme terms 6 and 2 will be in triple ratio, composed of the double and the hemiolic. And if you arrange them with the hemiolic as the addition and

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⁵²⁵ This seems to be what the statement means, where 'it' is the double ratio, but the sense in which it 'belongs to the class of unequals' is obscure (unless Porphyry is merely repeating, in different words, that it cannot be divided into two equal sub-ratios).

⁵²⁶ Literally, 'the hemiolic stands under it'. Porphyry presumably means that he is taking the ratio 3:2 as the starting-point or foundation of his calculation. See also the next note.

- τὸν ἡμιόλιον, ὑποτάξῃς δὲ τὸν διπλάσιον, τὸ αὐτὸ ἐκ τῶν ἄκρων ἀποβήσεται. εἰλήφθω γὰρ διπλάσιος λόγος ἐν ἀριθμοῖς τοῖς ζ' καὶ γ' καὶ προσειλήφθω ὁ ἡμιόλιος ὁ ζ' τοῦ θ'· ὁ ἄρα ἄκρος ὁ θ' τοῦ ἐτέρου ἄκρου τοῦ
- (10) γ' τριπλάσιός ἐστι συγκείμενος ἐξ ἡμιολίου καὶ τοῦ διπλασίου. τὸ μὲν οὖν διὰ πασῶν καὶ διὰ πέντε σύμφωνον διὰ ταύτην τὴν αἰτίαν παραβληθήσεται τῷ τριπλασίῳ. τὸ δὲ διὰ πασῶν καὶ διὰ τεσσάρων πολλαπλασίῳ μὲν ἢ ἐπιμορίῳ λόγῳ παραβαλεῖν οὐχ οἶόν τε, ἐπιμερεῖ δέ, καὶ ὃν ἀριθμός πρὸς ἀριθμὸν ἔχει λόγον, ὁ ἡ' πρὸς τὸν γ'.
- (15) ἔπει γὰρ ἐπίτριτος μὲν ὁ δ' τοῦ γ', διπλάσιος δ' ὁ η' τοῦ δ', οἱ ἄκροι οἱ ἡ' καὶ ὁ γ' ἐν ἐπιμερεῖ λόγῳ ἔσσονται συντιθέντες τι ἐκ τοῦ διπλασίου καὶ ἐπιτρίτου. κἂν προτάξῃς τὸν ἐπίτριτον, ὑποτάξῃς δὲ τὸν διπλάσιον, τὸ αὐτὸ ἀποβήσεται. εἰλήφθω γὰρ διπλάσιος ὁ ζ' τοῦ γ' καὶ προσειλήφθω ὁ ἐπίτριτος τοῦ ζ' ὁ η'· πάλιν οὖν οἱ ἄκροι ἐν ἐπιμερεῖ λόγῳ θεωρηθήσονται, ὃν ὁ η' ἔχει πρὸς τὸν γ', συγκειμένῳ ἐκ τοῦ ἐπιτρίτου καὶ τοῦ διπλασίου. εἰ μὲν οὖν ἡ διάταξις φησιν ἥρτητο ἐκ τοῦ δεῖν τὰ σύμφωνα ἐν πολλαπλασίοις ἢ ἐπιμορίοις λόγοις εἶναι, μηκέτι δὲ καὶ ἐν ἐπιμερέσιν, οὐκ ἔδει προσέσθαι τὴν τοιαύτην σύνθεσιν ὡς σύμφωνον. ἔπει οὐδὲν τοιοῦτον προϋποτίθεται, οὐ δεῖ φησι δυσωπεῖσθαι τὸ τοιοῦτον σύμφωνον, ὅτι μὴ ἐπιμόριον ἢ πολλαπλάσιόν ἐστιν.
- (25)

ἔξῃς δὲ μετὰ τὸν ἐπίτριτον λόγον γίνονται ἂν ἐγγυτέρω τῆς ἰσότητος οἱ συντιθέντες αὐτὸν ἐν συμμετρίαις ὑπεροχαῖς, του-

9 ὁ θ'] τοῦ θ' p 15 ὁ δ' τοῦ γ'] ὁ δ' τοῦ η' codd. 20 συγκειμένου p
in lemmate: 16.12 γίνονται codd. 13 συμμετρίοις p

the double as the basis,⁵²⁷ the extreme terms will give the same result. For let the double be taken in the numbers 6 and 3, and let there be taken in addition 9, the hemiolic of 6. Then the extreme term 9 is the triple | of the other extreme, 3, and consists of a hemiolic and a double.⁵²⁸ For this reason, then, the octave and a fifth will be correlated with the triple.

The octave and a fourth, however, cannot be correlated with a multiple or an epimoric ratio, but with an epimeric, the one that has a ratio, number to number, of 8 to 3.⁵²⁹ For since the | epitrittic is 4:3 and the double is 8:4, the extreme terms 8 and 3 will be in an epimeric ratio, composing something from the double and the epitrittic. And if you arrange them with the epitrittic as the addition and the double as the basis,⁵³⁰ the same result will occur. For let there be taken the double ratio of 6:3, and let there be taken in addition 8, the epitrittic of 6. Once again the extreme terms will be in an epimeric ratio, | that which 8 has to 3, composed of the epitrittic and the double. Thus, says Ptolemy, if the arrangement depended on the requirement that the concords must be in multiple or epimoric ratios and never in epimerics, a combination of this sort ought not to strike us as concordant. Since nothing of this sort has been postulated, he need not be embarrassed, he says, | by the fact that this kind of concord is neither epimoric nor multiple.⁵³¹

Next after the epitrittic ratio, those closer to equality will be those that come together to compose it and whose excesses are commensurable, that is, the

⁵²⁷ Literally, 'if you arrange the hemiolic in front and arrange the double below'; my version is a paraphrase which I think conveys the intended sense. Porphyry has first taken the hemiolic ratio as his starting-point or 'basis' (literally, he has 'placed it below') and has added the double; now he will do it the other way round. This interpretation would be easier if we emended *protaxëis* ('you arrange . . . in front') into *prostaxëis* ('you arrange . . . in addition') at 117.6, and again below at 117.17; but the verb *prostastein* occurs nowhere else in this text, whereas *protastein* reappears in a similar role at 144.13 and 144.30.

⁵²⁸ An equivalent result would be reached, of course, if we took the numbers 2 and 1 as the starting-point instead of 6 and 3. Probably Porphyry uses the latter numbers to represent the 'double' only because they have appeared in this role in the preceding calculation, which could not have been expressed in whole numbers if 2 and 1 had been used.

⁵²⁹ The phrase 'number to number' conveys the fact that the ratio in question, unlike every multiple or epimoric ratio, cannot be expressed in a single Greek word, but must be expressed as a relation between two distinct numbers. It appears for the first time in this connection at Plato *Tim.* 36b, and is quite common in later writings.

⁵³⁰ See n. 527 above.

⁵³¹ It is true that Ptolemy has not explicitly adopted the principle that all concords must be either multiple or epimoric, but he has come perilously close to doing so. He has agreed that 2:1 is the best of the ratios for a reason which guarantees that it will be multiple (*Harm.* 15.22-5); in discussing the ratios that most nearly divide it in half he implicitly assumes that they must be epimoric (15.29-16.1); and he asserts and seeks to justify the claim that all acceptable ratios of intervals smaller than the fourth are epimoric (16.12-21, quoted in the next lemma). One could perhaps offer him a suitable line of defence, but he does not provide it himself.

τέστιν οἱ ἐλάττους αὐτῶν τῶν ἐπιμορίων, μετὰ δὲ τοὺς συμφώνους ἐχόμενοι κατ' ἀρετὴν οἱ ἐμμελεῖς, οἷον ὁ τόνος καὶ ὅσοι συντιθέασιν τὴν [15] ἐλαχίστην τῶν συμφωνιῶν, ὥστε τοῦτοις ἐφαρμόζεσθαι τοὺς ὑπὸ τὸν ἐπίτριτον ἐπιμορίους λόγους. εἶεν δ' οὖν καὶ τούτων οἱ τε δίχα ἔγγιστα ποιοῦμενοι τινὰς διαιρέσεις ἐμμελέστεροι διὰ τὴν αὐτὴν αἰτίαν, καὶ ὅσων αἱ διαφοραὶ μείζονα περιέχουσιν ἀπλᾶ μέρη τῶν ὑπερεχομένων, ὅτι καὶ ταῦτα ἐγγυτέρω τοῦ ἴσου καθάπερ τὸ ἡμισυ πάντων μᾶλλον, εἴτα τὸ [20] τρίτον καὶ τῶν ἐφεξῆς ἕκαστον.

- (27) ὥσπερ μετὰ τὴν ἰσότητα ἐγγὺς ἦν ταύτης ὁ διπλάσιος λόγος, μετὰ δὲ τοῦτον ἐγγὺς πάλιν ἦσαν τούτου οἱ ἔγγιστα δίχα τέμνοντες τὸν διπλάσιον λόγον, οὗτοι δ' ἦσαν ὁ ἡμιόλιος καὶ ὁ ἐπίτριτος, οὕτω πάλιν μετὰ (30) τὸν ἐπίτριτον ἐν τοῖς ἐλάττοσιν αὐτοῦ ἐπιμορίοις θεωροῦνται οἱ ἐμμελεῖς. ἀρχὴ γὰρ ἐμμελῶν φθόγγων ἐν τοῖς μετὰ τὸν ἐπίτριτον ἐπιμορίοις,
- (118) ἐξ ὧν συντίθεσθαι δύναται καὶ εἰς οὓς διαιρεῖσθαι. μετὰ δὲ τὸν ἐπίτριτον οἱ ἐπιμόριοι ἄρχονται ἀπὸ τοῦ ἐπὶ δ' καὶ ἐπὶ ε' καὶ ἐπὶ ζ' οὕτως ἐπ' ἀπειρον· ὧν τινες αὐτὸν συνθεῖναι δύνανται, ὡς ἐπιδείξομεν. ἐμμελεῖς μὲν οὖν οἱ συντιθέντες αὐτὸν πάντες, αὐτῶν δὲ τούτων ἐμμελέστεροι, ὅσοι εἰσὶν τῇ ἀρίστη τῶν ὁμοφωνιῶν, ἥτις ἦν διὰ πασῶν, (5) μεθ' οὓς οἱ ἐμμελεῖς συντιθέασιν τὴν διὰ πασῶν. ἦσαν δ' οἱ τε τὸ ἡμισυ τοῦ ὑπερεχομένου κατὰ τὴν ὑπεροχὴν εἰληφότες καὶ οἱ τὸ τρίτον. τοιοῦτος γὰρ ὁ ἡμιόλιος καὶ ὁ ἐπίτριτος. τῶν μὲν οὖν ἐμμελῶν, ὅσοι δίχα ἔγγιστα ποιοῦνται διαιρέσεις, εἶεν ἂν ἐμμελέστατοι μεθ' οὓς, ὧν αἱ (10) διαφοραὶ μείζονα ἀπλᾶ μέρη περιέχουσι τῶν ὑπερεχομένων, ὅτι καὶ ταῦτα ἐγγυτέρω τοῦ ἴσου, καθάπερ ἐν ταῖς συμφωνίαις τὸ ἡμισυ πάντων μᾶλλον προουτέτακτο, ὃ προσῆν τῇ κατὰ τὸν ἡμιόλιον ὑπεροχῇ. τίνες

1 δύναται Alexanderson δύνανται codd. et Düring οὓς Wallis et Alexanderson codd. g secuti ἐν cet. codd. διαιρεῖσθαι Wallis et Alexanderson θεωρεῖσθαι Düring θεωρεῖται p^V187 διαιρεῖται G διαιρεῖσθαι θεωρεῖσθαι A 12 ἡμιόλιον Alexanderson ἐπίτριτον codd.

in lemmate: 16 ἐφαρμόττεσθαι codd. 17 οὖν] ἂν codd.

epimoric ratios that are smaller than these, and following the concords in excellence come the melodics, such as the tone and all those that come together to compose the smallest of the concords; so that to these we should fit the epimoric ratios that are smaller than the epitrititic. Of these, too, those that make divisions most nearly into halves must be more melodic, for the same reason, as are all those whose differences contain larger simple parts of those that are exceeded; for these, too, are nearer to the equal, just as the half is nearest of all, then the third, and then each of the others in succession. Ptol. *Harm.* 16.12–21

Just as after equality the ratio close to it was the double, and close after this again were those that most nearly divide the double ratio in half, which were the hemiolic and the epitrititic, so again, after | the epitrititic, the melodics are found in the epimorics that are smaller than it. For the beginning (*archē*) of melodic notes is in the epimorics after the epitrititic, those from which it can be put together and into which it can be divided.⁵³² After the epitrititic, the epimorics begin (*archontai*) from the *epitetartos* [5:4], the *epipemptos* [6:5], the *epihektos* [7:6], and so on indefinitely;⁵³³ and some of them can compose it [the epitrititic], as we shall show. Then all those that can compose it are melodic, and of them⁵³⁴ the more melodic are | those that resemble the best of the homophones, the octave, and after them [i.e. the homophones] those similar to them compose the octave. These were the ones in which the excess is half of that which is exceeded and those in which it is a third; and they are the hemiolic and the epitrititic. Then those of the melodics which most nearly make divisions into halves will be the most melodic, and after them will come those whose | differences contain greater simple parts of the terms that are exceeded, since these again are closer to the equal, just as in the concords the half was put ahead of all the rest, and was present in the excess belonging to the hemiolic.⁵³⁵ Ptolemy

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⁵³² Düring's reading at 118.1 is impossible. Alexanderson's, which I follow, has a sound basis in the MSS; it matches Porphyry's usage elsewhere and makes good sense. See his note ad loc.

⁵³³ I have not tried to anglicise the Greek expressions for these ratios as I have for the fundamental group. In the MSS of Porphyry, as often elsewhere, they are given in a short form consisting of the preposition *epi* followed by a numeral, ἐπὶ δ', ἐπὶ ε', and so on.

⁵³⁴ Grammatically, 'them' must refer to the ratios which (put together with others) can compose the epitrititic. But it becomes clear that Porphyry is in fact referring to the ratios of the octave, fifth and fourth as well as to the smaller intervals which can be combined to form the fourth. It is also strange that he seems to describe the ratio of the octave as 'more melodic' than the others, using for 'melodic' the same adjective (*emmeles*) as he and Ptolemy regularly apply to the smaller intervals into which the fourth can be divided, to distinguish them from the concords and the homophones (as indeed Porphyry does in the preceding clause and again below at 118.8). Something seems to have gone wrong, and I suspect that the text is corrupt.

⁵³⁵ The MSS reading here, 'epitrititic', is clearly a scribal error. The 'excess' of one term over the other in the hemiolic ratio (3:2) is half the smaller term. In the epitrititic (4:3) it is not; it is one third.

- οὖν οἱ συντιθέντες τὸν ἐπίτριτον λόγον τῶν ἐλαττόνων αὐτοῦ μορίων, αὐτὸς ἐπιδείξει ὕστερον, ὅταν κατὰ τὸ εὐλογον καὶ τὸ φαινόμενον τῶν
(15) τετραχόρδων καὶ κατὰ τὸ γένος ποιῇται διαιρέσεις.

συνελόντι δὲ εἰπεῖν ἐκ τούτων ὁμόφωνοι μὲν γίνονται ἂν ὁ τε πρῶτος πολλαπλάσιος καὶ οἱ ὑπ' αὐτοῦ μετρούμενοι, σύμφωνοι δὲ οἱ δύο πρῶτοι τῶν ἐπιμορίων καὶ οἱ ἐξ αὐτῶν καὶ τῶν ὁμοφώνων συντιθέμενοι, ἐμμελεῖς δὲ οἱ μετὰ τὸν ἐπίτριτον τῶν ἐπιμορίων. τῶν μὲν οὖν ὁμοφώνων καὶ τῶν συμφώνων ὁ ἴδιος ἐκά- [25] στοῦ λόγος εἴρηται, τῶν δὲ ἐμμελῶν ὁ μὲν τονιαῖος ἐπόγδοος ὧν ἐντεῦθεν συναπεδείχθη διὰ τῆς ὑπεροχῆς τῶν δύο πρῶτων ἐπιμορίων τε καὶ συμφώνων. οἱ δὲ τῶν λοιπῶν τὸν προσήκοντα διορισμὸν ἔξουσιν ἐν τοῖς οἰκείοις τόποις. νῦν δὲ καλῶς ἂν ἔχοι τὴν ἐνάργειαν ἀποδείξει τῶν ἤδη παραβεβλημένων, ἵνα τὸ πρὸς τὴν αἴσθησιν αὐτῶν ὁμολογούμενον [30] ἀδιστάκτως ἔχωμεν ὑποτεθειμένον.

- (18) Πρῶτος πολλαπλάσιος ἦν ὁ διπλάσιος· ὑπὸ δὲ τοῦ διπλασίου μετρεῖται ὁ τετραπλάσιος· οὗτοι δ' οἱ λόγοι ἀπεδόθησαν τῇ διὰ πασῶν καὶ τῇ
(20) δις καὶ τῇ τρίς, ὥσθ' ὁμόφωνοι αὐταί. ἐπιμόριοι δὲ πρῶτοι ὁ ἡμιόλιος καὶ ὁ ἐπίτριτος, οἷς ἀπεδόθησαν ἡ διὰ πέντε καὶ ἡ διὰ τεσσάρων· ἦν δὲ καὶ ὁ ἐκ τοῦ ἐπιτρίτου καὶ διπλασίου συντιθέμενος λόγος καὶ θεωρούμενος ἐν σχέσει ὀρισμῶν, ἦν ἔχει ἀριθμὸς πρὸς ἀριθμὸν, ὁ ἧ' πρὸς τὸν γ'. καὶ ὁ ἐκ τοῦ ἡμιολίου συντιθέμενος καὶ τοῦ διπλασίου καὶ ποιῶν
(25) λόγον τριπλάσιον· καὶ λοιπῶν εἴ τις ἐκ τοῦ ἐπιτρίτου καὶ τετραπλασίου συνετίθετο. ἀπεδίδοντο δ' οἱ εἰρημένοι τῇ τε δις διὰ πασῶν καὶ διὰ τεσσάρων καὶ τῇ τρίς διὰ πασῶν καὶ διὰ τεσσάρων καὶ τῇ δις διὰ πασῶν καὶ διὰ πέντε. αἱ δὲ πᾶσαι μετὰ τῆς διὰ πέντε καὶ ἔτι τῆς διὰ τεσσάρων συμφωνίαι καλείσθωσαν. πάλιν ἦσαν μετὰ τὸν ἐπίτριτον λόγοι ἐπιμό-
(30) ριοι οἱ μὲν ἐπιτέταρτοι, οἱ δ' ἐπίπεμπτοι, οἱ δ' ἐπίεκτοι, οἱ δ' ἐπιέβδομοι, οἱ δ' ἐπόγδοοι καὶ ἄλλοι πλείους, ὧν οἱ παραλαμβανόμενοι εἰς τὰς συνθέσεις τοῦ ἐπιτρίτου ἐμμελεῖς καλείσθωσαν, οὔσης κὰν τούτοις διαφορᾶς
(119) καθάπερ ἐπὶ τῶν συμφωνιῶν, καθ' ἣν οἱ ἐμμελέστεροι ῥηθήσονται αὐτῶν τῷ θεωρεῖσθαι ἐν ὑπεροχῇ μείζονι ἢ διαιρέσει παρίσοις, καθ' ἣν πλειόνων ἐν τοῖς οἰκείοις ἀποδειχθήσεται τόποις. ἐπεὶ δὲ ταῖς μὲν ὁμοφωνίαις καὶ ταῖς συμφωνίαις ἤδη ἀριθμοὶ τε καὶ λόγοι εἰσὶ παρα-
(5) βεβλημένοι, ταῖς δ' ἐμμελείαις οὐδέπω, πλὴν τῆς τονιαίας—ταύτη γὰρ ὁ ἐπόγδοος ἀποδέδεικται—τὰ μὲν κατὰ τὰς ἐμμελείας ἀπάσας ὥστε-

4 ἀριθμοὶ τε καὶ λόγοι Wallis ἀριθμοῖς τε καὶ λόγοις codd.

in lemmate: 16.30 προβεβλημένων codd. 31 ὑποτιθέμενον codd.

will explain later which ratios compose the epitritie ratio from parts smaller than itself, when he constructs the divisions of the tetrachords, genus by genus, | on the basis of what is rational and evident to perception.⁵³⁶

From these points we may say in summary that the first multiple and those measured by it are homophones, that the first two epimorics and those composed from them and the homophones are concordant, and that those of the epimorics that come after the epitritie are melodic. The ratio peculiar to each of the homophones and concords has been stated; and of the melodic class the tone has thus simultaneously been shown to be epogdoic, because of the difference between the first two epimorics and concords. The ratios of the remainder will receive their appropriate definition in the proper places. But now it would be a good thing to demonstrate the clear truth of those that have already been set out, so that we may have their agreement with perception established beyond dispute, as a basis for discussion. Ptol. *Harm.* 16.21–31

The first multiple is the double, and the quadruple is measured by the double. These [i.e. multiple] ratios were assigned to the octave and the | double octave and the triple octave; thus these are homophones. The first epimorics are the hemiolic and the epitritie, to which were assigned the fifth and the fourth. There was also the ratio composed from the epitritie and the double, represented in the relation of its terms, which are, as number to number, 8 to 3; and again that composed from the hemiolic and the double, making | the triple ratio. As to the rest, one was composed, for instance, from the epitritie and the quadruple. Those I mean were assigned to the double octave and a fourth, the triple octave and a fourth, and the double octave and a fifth; and all those that start from the fifth, or again from the fourth, should be called concordant. Again, after the epitritie ratio the epimorics are | the *epitetartoi* [5:4], the *epipemptoi* [6:5], the *epihektoi* [7:6], the *epihebdomoi* [8:7], the *epogdooi* [9:8] and many others, of which those brought into the composition of the epitritie should be called melodic. Among them too there is a difference, as in the case of the concords, by which some of them will be described as more melodic, because they have a larger excess,⁵³⁷ or nearly equal divisions, as will be shown through many considerations in the appropriate places.

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Since numbers and ratios have already been correlated with the homophones and the concords, | but not yet with the melodics except for the tone – to which the epogdoic has been shown to belong – we shall set out

⁵³⁶ The reference is to *Harm.* 1.15.

⁵³⁷ As at 118.6–12 and elsewhere, this means that the difference between the terms is a larger fraction of the smaller term, not that it is larger absolutely.

- (10) ρον διά τε λόγου καὶ τῆς ἐναργείας παραστήσομεν, τὰς δ' ὁμοφωνίας καὶ συμφωνίας, ἐπειδὴ διά τοῦ λόγου ἐξεύρομεν, αἵτινες εἶναι ὀφείλουσι φέρε καὶ διά τῆς ἐπιστημονικῆς αἰσθήσεως καὶ τῆς παρὰ ταύτης ἐναργείας τὰ εἰρημένα ἐπιδείξωμεν· οὕτω γὰρ τὰ τοῦ λόγου δειχθήσεται σύμφωνα ταῖς τῆς ἀκοῆς ἀντιλήψεσιν.

η'

Τὸ μὲν οὖν ἀπὸ τῶν αὐλῶν καὶ τῶν συρίγγων παριστάνειν τὸ προκει-
μενον ἢ τῶν περὶ τὰς χορδὰς ἐξαρτωμένων βαρῶν ἀφείσθω διά τὸ μὴ
[17] δύνασθαι τὰς τοιαύτας παραδείξεις ἐπὶ τὸ ἀκριβέστατον φθάνειν, ἀλλὰ
διαβολῆς μᾶλλον ἐμποιεῖν ἀφορμὰς τοῖς πειρωμένοις. ἐπὶ τε γὰρ τῶν
αὐλῶν καὶ τῶν συρίγγων μετὰ τοῦ δυσεξέταστον αὐτῶν εἶναι τὴν τῆς
ἀνωμαλίας διόρθωσιν, ἔτι καὶ τὰ πέρατα, πρὸς ἃ δεῖ τὰ μήκη παραβά-
λιν, ἐν πλάτει πως καθίσταται μετὰ τοῦ καὶ καθόλου τοῖς πλείστοις [5]
τῶν ἐμπνευστῶν ὀργάνων ἀταξίαν τινὰ προσγίνεσθαι καὶ παρὰ τὰς τοῦ
πνεύματος ἐμβολὰς. ἐπὶ τε τῶν ἐξαπτομένων ταῖς χορδαῖς βαρῶν μὴ
διασφωζομένων ἀπαραλλάκτων ἀλλήλαις παντάπασι τῶν χορδῶν, ὅποτε
καὶ πρὸς αὐτὴν ἐκάστην οὕτως ἔχουσιν εὐρεῖν ἔργον, οὐκέτι δυνατόν
ἔσται τοὺς τῶν βαρῶν λόγους ἐφαρμόσαι τοῖς γινομένοις δι' αὐτῶν [10]
ψόφοις τῷ καὶ τὰς πυκνοτέρας καὶ λεπτοτέρας ἐν ταῖς αὐταῖς τάσεσιν
ὀξυτέρους φθόγγους ποιεῖν. πολὺ δὲ ἔτι πρότερον κἂν ταῦτά τις ὑπόθη-
ται δυνατὰ καὶ ἔτι τὸ μήκος τῶν χορδῶν ἴσον, τὸ μεῖζον βάρος τῇ πλεί-
ονι τάσει τὴν τῆς ἀρτώσεως αὐτῷ χορδῇ διάστασιν αὐξήσει τε καὶ πυ-
κνώσει μᾶλλον, ὥστε καὶ διὰ τοῦτο συμπίπτειν τινὰ παρὰ τὸν λόγον τῶν [15]
βαρῶν ἐν τοῖς ψόφοις ὑπεροχὴν. τὰ παραπλήσια δὲ συμβαίνει κατὰ
τῶν κατὰ σύγκρουσιν γινομένων ψόφων, ὁποίους ἐπινοοῦσι τοὺς διὰ
τῶν ἀνισοβαρῶν σφυρῶν ἢ δίσκων καὶ τοὺς ἀπὸ τῶν τρυβλίων κενῶν τε
καὶ πεπληρωμένων, ἐργώδους ὄντος πάνυ τοῦ τηρεῖν ἐν ἅπασι τούτοις
τὴν ἐν ταῖς ὕλαις καὶ τοῖς σχήμασιν ἀπαραλλαξίαν. [20]

- (13) Τῶν Πυθαγορείων ἄλλοι ἄλλως διά τῶν ὀργάνων τὰ κατὰ τὰς συμ-
φωνίας ἐξέτασαν. οἱ μὲν γὰρ αὐλοὺς δύο ποιήσαντες χαλκοῦς ἢ καλὰ-

7 ἐνεργείας p 9 ἐνεργείας p 11 τέλος τοῦ ἐβδόμου κεφαλαίου add. p 12 κεφ. η' εἰς τὸ τὸ
μὲν οὖν ἀπὸ τῶν αὐλῶν G ἀρχὴ τοῦ ὀγδόου κεφαλαίου οὐ ἢ ἀρχὴ add. p 14 ἐξήτησαν g

the facts about all the melodics later on the basis of reason and of clear and distinct perception;⁵³⁸ and as for the homophones and concords, since we have discovered what they should be on the basis of reason, let us also demonstrate what we have said on the basis of scientific perception and the clear and distinct | testimony it gives.⁵³⁹ In this way the conclusion of reason will be shown to be concordant with the apprehension of hearing.

Chapter 8

Let us reject the attempt to base the proof we are seeking on *auloi* and *syringes*,⁵⁴⁰ or on weights suspended from strings, since such demonstrations cannot reach the peak of precision, but serve rather as a basis for attacks on those who undertake them. For in *auloi* and *syringes* it is difficult to find a way of correcting unevenness, and also the limits in relation to which the lengths must be compared are established only approximately; and there is also the fact that in general, some irregularity is introduced into most wind instruments by the impulses of the breath. In the case of weights attached to strings, where the strings are not kept in all respects identical with one another – since it is hard to find strings of which each is in this condition even with respect to itself – it will no longer be possible to fit the ratios of the weights to the sounds that arise through them, since denser and finer strings under the same tension make higher notes. Much more important even than that is the fact that even if one assumes that these things are possible, and again that the lengths of the strings are equal, the bigger weight by its greater tension will increase the length of the string attached to it, and will make it denser, so that from this too will arise a difference in the sounds that is not in accordance with the ratio of the weights. Similar things happen, too, with sounds arising from percussion, such as people contrive with spheres or discs of unequal weight, and with bowls, empty or full, since it is very hard to maintain identity of materials and shapes in all these things. Ptol. *Harm.* 16.32–17.20

Some of the Pythagoreans used instruments in one way and some in others, in their studies of the facts about the concords.⁵⁴¹ Thus some made *auloi*

⁵³⁸ The Cartesian phrase 'clear and distinct perception' represents tolerably well the sense of *enargeia* as it was used by some philosophers, especially the Epicureans, for whom sense-perception, under certain conditions, gives direct access to truth.

⁵³⁹ 'Clear and distinct testimony' again represents the noun *enargeia*; 'scientific perception' translates *epistēmonikē aisthēsis*, 'sense-perception that provides (or amounts to) knowledge'. This usage too is primarily Epicurean, but had already been employed by Speusippus (fr. 75 Tarán); cf. 16.2–4 above with n. 49.

⁵⁴⁰ The *syrinx* is the Panpipe.

⁵⁴¹ Allusions to these 'demonstrations' are common elsewhere, and are typically attributed to the early Pythagoreans; see e.g. Aelianus quoted at 33.16 ff. above, Nicomachus *Harm.* 6 and 10, Theo Smyrn. 59.4 ff. But some of the details Porphyry gives are not mentioned in other sources.

- (15) μους, ἰσοπαχεῖς καὶ ἰσοκοιλίους, εἰς συρίγγων τρόπον, ὧν ὁ ἕτερος τοῦ ἑτέρου διπλάσιος ἦν κατὰ μήκος, καὶ ἐμφυσῶντες τῷ στόματι εἰς τοὺς αὐλοὺς ἅμα διὰ τῶν ἐν αὐτοῖς γλωσσιδίῳν κατελάμβανον τὸ διὰ πασῶν σύμφωνον ἐν διπλασίονι λόγῳ· καὶ τὰς λοιπὰς δὲ συμφωνίας ἐν τοῖς οἰκείοις λόγοις κατελιφάσι τῶν αὐλῶν κατὰ μήκος λόγον ἔχόντων πρὸς
- (20) ἀλλήλους ὅτε μὲν τῶν τεσσάρων πρὸς τὰ τρία, ὅτε δὲ τῶν τριῶν πρὸς τὰ δύο, ὅτε δὲ τῶν τριῶν πρὸς τὸ ἕν, ὅτε δὲ τῶν τεσσάρων πρὸς τὸ ἕν· οὐδὲν δ' ἦττον δι' ἐνὸς αὐλοῦ τὸ προκείμενον αὐτοῖς ἀπέβαινε. τὸν γὰρ ὅλον αὐλὸν διελόντες ὅτε μὲν δίχα τοῦ διὰ πασῶν ἔνεκεν, ὅτε δ' εἰς τέσσαρα καὶ τρία, καὶ τὰ τρία μέρη ἀπολαμβάνοντες πρὸς τὴν γλωσσίδα
- (25) τοῦ διὰ τεσσάρων χάριν καὶ ἐπὶ τῶν ἄλλων κατὰ τοὺς οἰκείους λόγους ἐκάστης τῶν συμφωνιῶν τὰς διαιρέσεις ποιοῦμενοι καὶ κατ' αὐτῶν τρυπήματα ποιοῦντες καὶ ὁμοίως ἐμφυσῶντες εἰς τὸν αὐτόν, ἐξελάμβανον τὸ οἰκεῖον σύμφωνον. ὡσαύτως καὶ ἐκ τοῦ ὕδρα, ἐξ οὗ οἱ ἐπικείμενοι αὐλοὶ ἄνισοι ὄντες τὰς ἀρμονίας ἀποτελοῦσιν. ἕτεροι δὲ λαβόντες ἴσας
- (30) χορδὰς κατέτειναν ἐξάπαντες τῆς μὲν ἑτέρας βάρη δύο μνῶν, τῆς δ' ἐτέρας μῖα μνᾶ· καὶ ὁξύτερος ὁ φθόγγος ἀπέβαινε αὐτοῖς, καθ' ἣς ἀπήρτησαν τὰς δύο μνᾶς, βαρύτερος δέ, καθ' ἣς ἀπήρτησαν τὸ μναιαῖον·

of bronze or reed, | equal in thickness and with equal bores, in the manner of *syringes*.⁵⁴² One of them was twice the length of the other; and by blowing with their mouth into the *auloi* simultaneously, through their mouthpieces,⁵⁴³ they found the octave concord in the double ratio. They found the remaining concords in the appropriate ratios with *auloi* the ratio of whose lengths to | one another was sometimes that of 4:3, sometimes that of 3 to 2, sometimes that of 3:1, and sometimes that of 4:1.⁵⁴⁴ They got this result no less when using a single *aulos*. For after dividing the whole *aulos* sometimes in half to give the octave, sometimes into four or three, marking off the three parts next to the mouthpiece | to give the fourth,⁵⁴⁵ and making divisions for the other concords according to the ratios appropriate to each, they then made finger-holes on the basis of the divisions, and by blowing evenly into the same *aulos* they found the appropriate concord.⁵⁴⁶ The same results came from the *hydras*,⁵⁴⁷ on which the unequal *auloi* that are fitted to it produce the *harmoniai*.

Others took equal | strings, and stretched them by attaching weights of two *mnai* to one of them and one *mna* to the other.⁵⁴⁸ The higher note of the two came from the string weighted with two *mnai*, and the

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⁵⁴² It becomes clear in the sequel that these are *auloi* with reed mouthpieces (like those of normal *auloi*). They are not *syringes* (Panpipes), which like their modern counterparts were sounded by breath directed across the open end of the pipes. They were made 'in the manner of *syringes*' only in the sense that they had no finger-holes, and their pitches were determined only by their lengths. Each could therefore produce only one note, and they were not performing instruments; Porphyry makes it clear that they were constructed by the Pythagorean researchers themselves. His report is very plausible, but we have no way of checking its reliability.

⁵⁴³ The term used here is *glossidia* 'little tongues', referring to the two blades of a double-reed akin to that of an oboe or bassoon.

⁵⁴⁴ Porphyry's omission of the ratio corresponding to the octave plus fourth, 8:3, is of course deliberate, since the Pythagoreans did not recognise this interval as a concord; see e.g. 112.14–19 above.

⁵⁴⁵ Here the *aulos* is not marked off into $4+3 = 7$ parts but simply into 4. The note from a finger-hole placed three 'parts' from the mouthpiece should then sound a fourth above that from the four-part length.

⁵⁴⁶ Porphyry again implies that the researchers were involved in the construction or at least the design of their *auloi*, though in this case only in dictating where the finger-holes should be placed. In other respects these instruments will have been identical with those used by performing musicians. The description of their procedure's steps shows clear affinities with those used in connection with the *kanōn* or monochord to which most of this chapter is devoted.

⁵⁴⁷ This is the 'water-organ', usually called the *hydraulis*; the *auloi* that Porphyry mentions are its pipes. For a description and references see West (1992): 114–18. It is said to have been invented by Ctesibius of Alexandria in the third century BC, and was certainly not known in Greece before that period; hence it cannot have figured in the demonstrations of the early Pythagoreans. Later theorists of the sort that Ptolemy and Porphyry call 'Pythagoreans' may well have paid it some attention, however; it is mentioned for instance in Nicom. *Harm.* 4. Porphyry's name for it, *hydras*, is not found elsewhere; its form is comparable to that of the names of several instruments originating in places to the East of the Mediterranean, such as *nablas* and *gingras*, and Porphyry's usage may perhaps reflect his own Eastern background.

⁵⁴⁸ A *mna* or 'mina' is a unit of weight, probably equivalent to about 8 ounces or 230 grams.

- ἐγίνετο δ' αὐτοῖς ἡ διὰ πασῶν συμφωνία. καὶ ἐπὶ τῶν ἄλλων δὲ συμφωνιῶν τὴν ὁμοίαν ἐξέτασιν ποιούμενοι τοὺς οἰκείους τῶν συμφωνιῶν
- (5) λόγους ἐλάμβανον διὰ τῶν βαρῶν, τουτέστι μναῖς τέσσαρας πρὸς τρεῖς μναῖς ἐξάψαντες καὶ τρεῖς πρὸς δύο καὶ τρεῖς πρὸς μίαν καὶ τέσσαρας πρὸς μίαν.

- Κατὰ ταῦτα δὲ καὶ τρυβλία ἢ ἀγγεῖα τῷ ῥυθμῷ καὶ σχήματι καὶ τῆς αὐτῆς ὕλης παρασκευασάμενοι ἴσα τὸ μὲν πρῶτον εἶασαν κενόν, τὸ δ'
- (10) ἕτερον ἐπλήρωσαν εἰς ὕδατος ἡμισυ, ὥστε τὸν ἐν τῷ κενῷ ἄερα διπλασίονα γίνεσθαι τοῦ ἔχοντος μέχρι τοῦ ἡμίσεος τὸ ὕδωρ. κρουομένων δὲ τῶν τρυβλίων ἐγίνετο αὐτοῖς ἡ διὰ πασῶν συμφωνία. δῆλον δ', ὅπως καὶ ἡ διὰ πέντε καὶ ἡ διὰ τεσσάρων καὶ αἱ λοιπαὶ αὐτοῖς ἐγίνοντο. ὡσαύτως δὲ καὶ ἐάν τις δίσκους χαλκοῦς ποιήσας διπλασιάσῃ θατέρου τὸν
- (15) ἕτερον, συμφωνοῦσι κρουόμενα διὰ πασῶν· πάντα γὰρ τὰ τοιαῦτα ἐκείνων ἐστὶ πρῶτον.

- Ἄλλοι δὲ τούτων δοκοῦντες ἔτι ἄμεινον φρονεῖν ἔλεγον, ὅτι ἐκ τῆς τοῦ κανόνος κατατομῆς εὐρέθησαν οἱ λόγοι, καὶ δοκεῖ μοι καλῶς λέγεσθαι. διότι καὶ ὁ Πτολεμαῖος πάντα τὰ προειρημένα παραιτησάμενος,
- (20) δι' ἧς εἶρηκεν αὐτὸς αἰτίας, ἐπὶ τὴν τοῦ κανόνος κατατομὴν ἤλθεν. ἐπὶ τε γὰρ τῶν αὐλῶν καὶ τῶν συρίγγων φησὶ μετὰ τοῦ δυσεξέταστον αὐτῶν εἶναι τὴν τῆς ἀνωμαλίας διόρθωσιν, ὡς τῶν καλάμων ὅπου μὲν εὐρυτέρων ὄντων, ὅπου δὲ στενωτέρων, ἔτι καὶ τὰ πέρατα αὐτῶν οἷα τὰ σχήματα, πρὸς ἃ δεῖ τὰ μήκη παραβάλλειν, ἐν πλάτει πῶς καὶ οὐκ ἀκριβῶς
- (25) γίνεται χωρὶς τοῦ καὶ ἐν πᾶσιν ἀπλῶς τοῖς πλείστοις τῶν ἐμπνευστῶν

lower from the string weighted with one; and they made the concord of the octave. And when they investigated the other concords in the same way, they constructed the ratios appropriate | to the concords by means of the weights, that is, by attaching four *mnai* in relation to three, and three in relation to two, and three in relation to one, and four in relation to one.⁵⁴⁹ In the same way, after providing themselves with equal-sized bowls or vessels <identical> in form and shape and made of the same material, they left the first empty and filled the | other with water up to halfway, so that the air in the empty one was double that of the one that was half-filled with water. When the bowls were struck they produced the concord of the octave; and it is obvious how the fifth and the fourth and the other concords were produced through them.⁵⁵⁰ Similarly, if one makes two bronze discs, making one double the | other, when struck they will be concordant at the octave.⁵⁵¹ For all such procedures belong first to them.⁵⁵²

Others among them who thought they had better opinions said that the ratios were to be found through the division of the *kanōn*, and it seems to me that they were right.⁵⁵³ This is why Ptolemy dismissed all the things described above, | for reasons he has given himself, and turned to the division of the *kanōn*. For he says that the difficulty of assessment, in the cases of *auloi* and *syringes*, is in the correction of unevenness, since reeds are wider in some places and narrower in others; and like their shapes, their limits, too, up to which the lengths must be compared, are approximate and not precise | – quite apart from the fact that in virtually all cases in most

⁵⁴⁹ These procedures are mentioned frequently (e.g. Nicom. *Harm.* 6, where they are attributed to Pythagoras and described in graphic detail), but they are notoriously flawed. This is not merely because of the problems identified by Ptolemy in the passage Porphyry is commenting on. The ratios of the pitches do not vary directly with the weights, but with their square roots. Hence the procedure, as it is regularly described, cannot produce the appropriate results.

⁵⁵⁰ This procedure also fails, as any simple test will show.

⁵⁵¹ This will work so long as the discs are of equal diameter, and their thicknesses differ in the appropriate ratio. It is not obvious that this is what Porphyry meant; but cf. the schol. to Plato *Phaedo* 108d4 (= DK 18.12 = Aristox. fr. 90 Wehrli) and Creese (2010): 101–2.

⁵⁵² This is probably what the remark means. An alternative and more problematic translation would be 'For all such things belong to those things first.' On that interpretation, perhaps 'such things' are the concords produced by any sort of instrument, and 'those things' are the ratios; concordance is 'first' or 'primarily' a relation between numbers, and only secondly an attribute of sounds. Alternatively 'such things' might be the ratios and 'those things' the instruments, the implicit point being that the ratios belong primarily to dimensions of instruments and only secondarily to sounds. Either of these would make sense, but the context provides no clear way of identifying the items to which 'such things' and 'those things' would refer.

⁵⁵³ There is no solid evidence that the *kanōn* or monochord was used by the immediate followers of Pythagoras; the earliest allusion to it that we have comes from the late fourth century BC (Duris fr. 23 Jacoby). The first account of a harmonic 'division' of the monochord's string is in Propositions 19–20 of the Euclidean *Sect. can.* On the issues see Creese (2010): 97–104.

- ὀργάνων ἀταξίαν τινὰ προσγίνεσθαι καὶ παρὰ τὰς τοῦ πνεύματος ἐμβολάς. εἰ μὲν γὰρ ἡ διόλου κίνησις τοῦ διπλασίου φέρε αὐλοῦ ὁμοία ἦν τῇ κινήσει τῇ διὰ τοῦ ἡμίσεος αὐλοῦ, κἄν ἀπήρκεσεν ἡμῖν διπλασίαν λέγειν τὴν κίνησιν τῇ κινήσει· νυνὶ δ' ἡμῖν ἕως τοῦ ἡμίσεος τοῦ μείζονος αὐλοῦ
- (30) γίνεται ἴσα γὰρ τὰ μήκη· ἡ δὲ ἀπὸ τοῦ ἡμίσεος τοῦ μείζονος οὐχ ὁμοία ἐστίν, ἀλλὰ βραδυτέρα τοῦ πνεύματος οὐχ ὁμαλῶς δι' ὅλου τοῦ αὐλοῦ φερομένου, ἀλλὰ χαλατονοῦντος ἐν τοῖς μακροτέροις διαστήμασιν· ὅθεν οὐ γίνεται ἡ κίνησις τῆς κινήσεως διπλασία. ἐκβάλλει οὖν
- (35) τὴν ἀπὸ τῶν αὐλῶν ἢ τῶν συρίγγων λῆψιν, ἐκβάλλει δὲ καὶ τὴν διὰ τῶν χορδῶν. λέγει γάρ· “ἐπὶ τε τῶν ἐξαπτομένων ταῖς χορδαῖς βαρῶν μὴ
- (121) διασφωζομένων ἀπαρallάκτως ἀλλήλαις παντάπασιν τῶν χορδῶν, ὁπότε καὶ πρὸς ἑαυτὴν ἐκάστην οὕτως ἔχουσιν εὐρεῖν ἔργον.” εὐλόγως. ἐπεὶ οὐδὲ τὴν μίαν χορδὴν ἐστὶν ἰδεῖν ῥαδίως ὁμοίως ἔχουσιν κατὰ πᾶν μέρος, μήπου γε καὶ δύο χορδὰς ἐκ νεύρων πεποιημένας ἢ ἐξ ἐντέρων ἴσας
- (5) τε τοῖς μήκεσι καὶ ἴσας τοῖς πάχεσι καὶ τῇ ξηρασίᾳ καὶ πυκνότητι καὶ ὁμαλότητι. κἄν ταῦτά τίς φησιν ὑπόθηται δυνατὰ καὶ ἔτι τὸ μήκος τῶν χορδῶν ἴσον καὶ ἐκ μὲν τῆς ἐτέρας τρεῖς μνᾶς κρεμάσῃ, ἐκ δὲ τῆς λοιπῆς μνᾶς δύο, τὸ τρίμουν βάρος τῇ πλείονι τάσει μείζονα ποιήσῃ καὶ πυκνώσῃ τὴν διάστασιν τῆς κρημνώσεως αὐτὸ χορδῆς, ὥστ' οὔτε μήκει ἔσσονται ἴσαι, οὔτ' ἰσόπυκνοι. τὰ παραπλήσια δὲ συμβαίνει καὶ ἐπὶ τῶν γινομένων ψόφων κατὰ σύγκρουσιν σφαιρῶν ναστῶν ἢ δίσκων κοίλων ἢ ἀγγείων ἴσων καὶ ὁμοίων κενῶν τε καὶ λαμβανόντων ὕδωρ, δυσχεροῦς ὄντος πάνυ τοῦ τηρεῖν ἐν ἅπασιν τούτοις καὶ τὸ ἐν ταῖς ὕλαις καὶ τοῖς σχήμασιν αὐτῶν ἀδιάφορον.

27 μὲν scripsi μὴ codd.

28 ἀπήρκεσαν g

30 ἀπὸ Alexanderson διὰ codd.

31 βραδυτέρα

Alexanderson βραδυτάτη codd.

9 αὐτὸ Alexanderson αὐτῆς codd.

14 διάφορον g

wind instruments some disorder arises also from the impulses of breath. For if the movement through the whole of the double-length *aulos*, for instance, were the same as the movement through the half-*aulos*, it would be justifiable for us to say that the one movement is double the other. But as it is, this happens up to halfway on the larger *aulos*, | since the lengths are equal; but the movement of breath after halfway on the larger *aulos* is not the same but is slower, and it does not travel evenly through the whole *aulos*, but slackens its speed in the greater distances. Hence the one movement is not double the other.⁵⁵⁴

Ptolemy therefore rejects the procedure based on *auloi* or *syringes*, and he also rejects the one based on | strings. For he says, 'In the case of weights attached to strings, where the strings are not kept in all respects identical with one another – since it is hard to find strings of which each is in this condition even with respect to itself;⁵⁵⁵ and he says this with good reason. Since one cannot easily find even one string which is the same in every part, one can surely not find two strings, made of sinews or guts, | that are equal in length and equal in thickness and dryness and density and evenness. And even if someone postulates, he says, that these things are possible and that the lengths of the strings are equal, and if he suspends three *mnai* from one and two *mnai* from the other, the three-*mna* weight through the greater tension will make the extent of the string suspending it longer and denser, so that the strings will no longer be equal | either in length or in density. Comparable things arise with the sounds made by striking empty spheres or hollow discs, or vessels that are equal and similar, empty and containing water, since in all these things it is very difficult to maintain the absence of difference both in their materials and in their shapes.

[121D]

⁵⁵⁴ There are some textual difficulties here, but the overall sense is not in doubt. When we have two *auloi*, one twice the length of the other, the breath travels through the first half of the longer at the same speed as it does through the whole of the shorter, 'since the lengths are equal'. But in the second half of its journey through the longer *aulos* its speed becomes slower (on the grounds that moving objects slow down as they get further from the source that gave them their initial impetus). Hence the movement through the longer *aulos* will not be exactly twice the movement through the shorter, in the sense that it will not take exactly twice as long. This is ingenious, but it is not a cogent objection to the idea most commonly used to explain the relation between the pitches of the resulting notes, which is that the movement of breath through the longer pipe strikes the external air at half the speed of the movement through the shorter; see e.g. Archytas fr. 1, Theo Smyrn. 60.19 ff., Aelianus quoted at 33.28–34.7 above. That theory presupposes Porphyry's contention, rather than conflicting with it, since it assumes that the breath slows down progressively as it passes through the pipe. Porphyry seems in any case to misunderstand Ptolemy's allusion to the 'irregularities' arising from impulses of breath, which probably means only that the player cannot always blow into the instrument with exactly the same force or at the same speed.

⁵⁵⁵ Ptol. *Harm.* 17.7–9, part of the lemma at the head of this passage.

ἡ δὲ ἐπὶ τοῦ κα- [20]

λουμένου κανόνος διατεινομένη χορδὴ δείξει μὲν ἡμῖν τοὺς λόγους τῶν συμφωνιῶν ἀκριβέστερόν τε καὶ προχειρότερον, οὐ μὴν ὡς ἔτυχε λαβοῦσα τὴν τάσιν, ἀλλὰ πρῶτον μὲν μετὰ τινος ἀνακρίσεως πρὸς τὴν ἐσομένην ἂν ἐκ τῆς κατασκευῆς ἀνωμαλίαν, ἔπειτα καὶ τῶν περάτων τὴν προσήκουσαν λαμβανόντων θέσιν, ἵνα τὰ πέρατα τῶν ἐν αὐτοῖς ἀποψαλμάτων, οἷς ὀρίζεται τὸ πᾶν μῆκος, οἰκείας τε καὶ δῆλας ἔχη τὰς ἀρχάς. [25]

Νοεῖσθω δὴ κανὼν ὁ κατὰ τὴν ΑΒΓΔ εὐθεῖαν καὶ μαγάδες πρὸς τοῖς πέρασιν αὐτοῦ πανταχόθεν ἴσαι τε καὶ ὅμοιαι σφαιρικές, ὡς ἐνὶ μάλιστα, ποιοῦσαι τὰς ὑπὸ τὰς χορδὰς ἐπιφανείας, ἥ τε ΒΕ περὶ κέντρον τῆς εἰρημένης ἐπιφανείας τὸ Ζ, καὶ ἡ ΓΗ περὶ κέντρον ὁμοίως τὸ [30] [18] Θ, ληφθέντων τε τῶν Ε καὶ Η σημείων κατὰ τὰς διχοτομίας τῶν κυρτῶν ἐπιφανειῶν. θέσιν ἐχέτωσαν τοιαύτην αἱ μαγάδες, ὥστε τὰς διὰ τῶν Ε καὶ Η διχοτομιῶν καὶ τῶν Ζ Θ κέντρων ἐκβαλλομένας, τουτέστι τὴν ΕΖΒ καὶ τὴν ΗΘΓ καθέτους εἶναι πρὸς τὴν ΑΒΓΔ. ἐὰν τοίνυν ἀπὸ

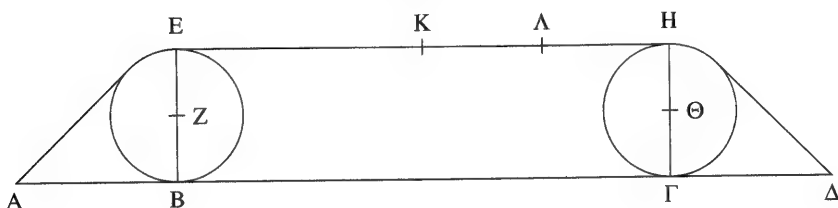


Figure 1G

τῶν Α καὶ Δ διατείνωμεν χορδὴν σύμμετρον, ὡς τὴν ΑΕΗΔ, παράλ- [5] ληλός τε ἔσται τῇ ΑΒΓΔ, διὰ τὸ ἴσον ὕψος ἔχειν τὰς μαγάδας. καὶ λήψεται κατὰ τὰ Ε καὶ Η σημεῖα τὰς ἀρχὰς τῶν ἀποψαλμάτων. ἐπ' αὐτῶν γὰρ ποιήσεται τὰς ἐπαφὰς τῶν κυρτῶν ἐπιφανειῶν, διὰ τὸ τὰς ΕΖΒ καὶ ΗΘΓ καθέτους γίνεσθαι καὶ πρὸς αὐτήν. ἐφαρμόσαντες δὲ τῇ χορδῇ κανόνιον καὶ μεταλαβόντες ἐπ' αὐτοῦ τὸ ΕΗ μῆκος, ἵνα προ- [10] χειρότερον ποιῶμεθα τὰς παραμετρήσεις, πρῶτον μὲν ἐπὶ τὴν γινόμενην τοῦ ὅλου μήκους διχοτομίαν, οἷον τὴν Κ, καὶ ἔτι τὴν τῆς ἡμισείας διχοτομίαν, ὡς τὴν Λ, καταστήσομεν ὑπαγώγια στενὰ εὖ μάλα καὶ λεῖα, ἥ καὶ νῆ Δία μαγάδια ἕτερα, ὑψηλότερα μὲν ἐκείνων βραχεῖ, ἀπαρ- λάκτως δὲ ἔχοντα, θέσεως ἕνεκεν, ἰσότητος καὶ ὁμοιότητος κατὰ τῆς [15] μέσης τοῦ κυρτώματος γραμμῆς, ἥτις ὑπ' αὐτὴν ἔσται τὴν τοῦ κανονίου διχοτομίαν ἢ πάλιν τὴν τῆς ἡμισείας διχοτομίαν, ἵνα ἐὰν μὲν τὸ ΕΚ τῆς χορδῆς μέρος ἰσότονον εὑρίσκηται τῷ ΚΗ καὶ ἔτι τὸ ΚΛ τῷ ΛΗ, δῆλον ἡμῖν αὐτῆς ἢ τὸ κατὰ τὴν σύστασιν ἀπαράλλακτον. ἐὰν δὲ μὴ, μεταφέ- ρωμεν τὴν δοκιμασίαν ἐπ' ἄλλο μέρος, ἥτοι χορδὴν ἄλλην, ἕως ἂν τὸ [20]

| But⁵⁵⁶ the string stretched over the *kanōn* will show us the ratios of the concords more accurately and readily, since it does not acquire its pitch in any random way, but in the first place is equipped with a way of diagnosing any unevenness that might arise from the apparatus, and secondly its limits are suitably placed so that the limits of the plucked sections between them, into which the whole length is divided, have appropriate and clearly detectable points of origin. Let us think of a *kanōn* on the straight line ABCD, and at its limits bridges that are in all respects equal and similar, with the surfaces that lie under the string as nearly as possible spherical. Let one bridge, BE, have Z as the centre of the surface mentioned, and let the other, CH, have F, similarly, at the centre, where points E and H are found by the bisection of the convex surfaces. Let the bridges be so placed that the lines drawn through the points of bisection E and H and through the centres Z and F – that is, EZB and HFC – are perpendicular to ABCD. If then from A and D we stretch a

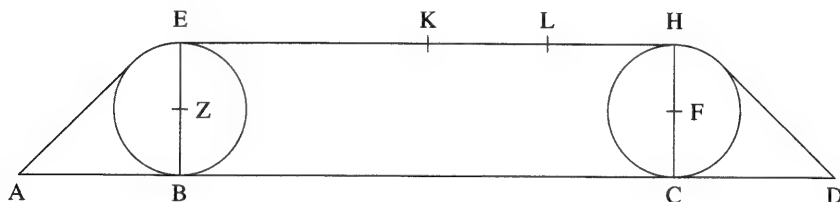


Figure 1

string of appropriate length, AEHD, it will be parallel to ABCD, because the bridges have equal height; and at points E and H it will have the beginnings of its plucked sections. For it is at these points that it will touch the curved surfaces, since EZB and HFC are perpendicular to it too. To the string we shall now fit a measuring-rod and use it to divide up the length EH, so that we may make the comparative measurements more easily. First, at the bisection of the whole length, K, and then at the bisection of the half, L, we shall place blades, very thin and smooth, or indeed further bridges, a little higher than the others but no different from them in respect of their position, equality or similarity about the line in the middle of the convexity, which will be under the exact bisection of the measuring-rod or again under the bisection of the half. Then if part EK of the string is found to be of equal pitch to KH, and again KL to LH, the string's evenness of constitution will be evident to us. If they are not so, let us transfer the test to another part, or to another string, until the required consequence is preserved – that is, sameness of pitch in parts that are similar, corresponding, equal in length and of a single tension. When something of

⁵⁵⁶ Here and in the sequel I have represented the Greek letters used by Ptolemy and Porphyry, in their descriptions of the figures and instruments, by letters in the modern Roman alphabet, with arbitrary substitutions where no immediate equivalents are available.

ἀκόλουθον διασωθῇ, τουτέστι τὸ ἐν τοῖς ὁμοίοις καὶ ἀναλόγοις καὶ ἰσομήκεσι καὶ μίαν ἔχουσι τάσιν ὁμότονον. ἔπειτα τοῦ τοιούτου καταληφθέντος καὶ καταδιαιρεθέντος τοῦ κανονίου τοῖς ἐκκειμένοις τῶν συμφωνιῶν λόγοις, εὐρήσομεν ἐκ τῆς ἐφ' ἑκάστον τμήμα τοῦ μαγαδίου παραγωγῆς ὁμολογουμένης ταῖς ἀκοαῖς ἐπὶ τὸ ἀκριβέστατον τὰς τῶν [25] [19] οἰκείων φθόγγων διαφοράς. τοιούτων μὲν γὰρ λαμβανομένης τῆς ΕΚ διαστάσεως τεσσάρων, οἷων ἐστὶν ἡ ΚΗ τριῶν, οἱ καθ' ἑκάτερον αὐτῶν φθόγγοι ποιήσουσι τὴν διὰ τεσσάρων συμφωνίαν διὰ τὸν ἐπίτритον λόγον. τοιούτων δὲ λαμβανομένης τῆς ΕΚ τριῶν, οἷων ἐστὶν ἡ ΚΗ δύο, ποιήσουσιν οἱ καθ' ἑκάτερον φθόγγοι τὴν διὰ πέντε συμφωνίαν διὰ τὸν [5] ἡμιόλιον λόγον. καὶ πάλιν ἂν μὲν οὕτως διαιρεθῇ τὸ πᾶν μῆκος, ὥστε τὴν μὲν ΕΚ γίνεσθαι δύο τμημάτων, τὴν δὲ ΚΗ τοῦ αὐτοῦ ἑνός, ἔσται τὸ διὰ πασῶν ὁμόφωνον παρὰ τὸν διπλάσιον λόγον. ἂν δὲ ὥστε τὴν μὲν ΕΚ συνάγεσθαι τμημάτων ὀκτώ, τὴν δὲ ΚΗ τῶν αὐτῶν τριῶν, ἡ διὰ πασῶν καὶ διὰ τεσσάρων ἔσται συμφωνία κατὰ τὸν ὀκτὼ πρὸς τὰ τρία [10] λόγον. ἂν δὲ ὥστε τὴν μὲν ΕΚ τμημάτων εἶναι τριῶν, τὴν δὲ ΚΗ τοῦ αὐτοῦ ἑνός, ἡ διὰ πέντε καὶ διὰ πασῶν ἔσται συμφωνία κατὰ τὸν τριπλάσιον λόγον. ἂν δὲ ὥστε τὴν μὲν ΕΚ συνάγεσθαι τμημάτων τεσσάρων, τὴν δὲ ΚΗ τοῦ αὐτοῦ ἑνός, ἔσται τὸ δις διὰ πασῶν ὁμόφωνον παρὰ τὸν τετραπλάσιον λόγον. [15]

- (17) Νοείσθω ἐπὶ τῆς ἄνω τοῦ κανόνος ἐπιφανείας ξυλίνου ὄντος καὶ συμμετρου τῷ μήκει εὐθεία γεγραμμένη δίχα διαιροῦσα τὸ πλάτος αὐτῆς ἢ ΑΒΓΔ· καὶ ἀπὸ τῶν Α καὶ Δ περάτων ἴσων ἀποληφθεισῶν δύο στάσεων συμμετρῶν τῶν ΑΒ καὶ ΓΔ ὡς ἐκ δακτύλων τριῶν, κέντροις τοῖς ΒΓ καὶ διαστήματι τῷ ἡμίσει τοῦ πλάτους τοῦ κανόνος γεγράφωσαν ἴσαι δύο κύκλοι, ὧν διάμετροι νοείσθωσαν ἴσοι τῇ ΑΒ. καὶ μαγάδες ἔστωσαν ἀπὸ κεράτων πεποιημένοι πανταχόθεν ἴσαι τε καὶ ὅμοιαι μέχρι μὲν τινος ὕψους κυλινδρικά οὔσαι, σφαιρικός δ' ἔχουσαι τὰς ὑπὸ τὴν
- (25) χορδὴν πιπτούσας ἐπιφανείας, ἡ ΕΒ περὶ κέντρον τὸ Ζ καὶ ἡ ΓΗ περὶ κέντρον ὁμοίως τὸ Θ. καὶ ληφθέντων τῶν Ε καὶ Η σημείων κατὰ τὰς διχοτομίας τῶν κυρτοτήτων, θέσιν ἐχέτωσαν τοιαύτην αἱ μαγάδες, ὥστε καὶ <τάς> διὰ τῶν Ε Η διχοτομιῶν καὶ τῶν Ζ καὶ Θ ἐκατέρων ἐκβαλλομένης εὐθείας, τουτέστιν τὴν ΕΖΒ καὶ τὴν ΗΘΓ, καθέτους εἶναι
- (30) πρὸς τὴν ΑΒΓΔ καὶ τὰς ΒΖ καὶ ΘΓ ἴσας διαστάσεις ἄξονας εἶναι τῶν κυλίνδρων, ὧν βάσεις αἱ περὶ διαμέτρους ἴσαι τῇ ΑΒ εὐθείᾳ. ἂν οὖν
- (122) ἀπὸ τῶν Α καὶ Δ διατείνωμεν χορδὴν ἐκ νεύρου πεποιημένην σύμμετρον

22 ἴσοι τῇ ΑΒ Düring ᾠβ codd. ἐπὶ ΑΒ Wallis 28 <τάς> add. Düring διχοτομιῶν Düring διχοτομίας codd. 31 ἴσαι τῇ ΑΒ εὐθείᾳ Düring ᾠβ εὐθείας G 5 ᾠβ εὐθείας p^v187 ἐπὶ ΑΒ Wallis

this kind has been found, and the measuring-rod has been divided in the ratios of the concords that have been set out, by shifting the bridge to each point of division we shall find that the differences of the appropriate notes agree most accurately with the hearing. For if distance EK is constructed of four such parts as those of which KH is three, the notes corresponding to each of them will make the concord of a fourth through the epitritic ratio. If EK is constructed of three such parts as those of which KH is two, the notes corresponding to each will make the concord of a fifth through the hemiolic ratio. And again, if the whole length is so divided that EK is made up of two sections and KH of one that is the same, there will be the homophone of the octave, in accordance with the double ratio. If it is divided so that EK is put together from eight sections and KH from three of the same, there will be the concord of an octave and a fourth, corresponding to the ratio of 8 to 3. If it is divided so that EK is of three sections and KH of one that is the same, there will be the concord of an octave and a fifth, corresponding to the triple ratio. And if it is divided so that EK is put together from four sections and KH from one that is the same, there will be the homophone of the double octave, in accordance with the quadruple ratio. Ptol. *Harm.* 17.20–19.15

Let us think of a straight line ABCD, drawn on the upper surface of the *kanōn* – which is wooden, and of a convenient length – dividing its width in half; and when two spaces, | AB and CD, of a suitable size – three finger-breadths, for instance – have been taken from the limits A and D, let there be drawn two equal circles half the width of the *kanōn* across, with their centres on B and C, whose diameters should be equal to AB.⁵⁵⁷ Then let there be placed bridges made of horn, equal and similar in every dimension, which are cylindrical up to a certain height; but the surfaces lying under the | string are spherical, that of bridge EB with Z as its centre, and that of bridge CH, similarly, with F as its centre. And when points E and H are taken by reference to the bisection of the convexity, let the bridges be so placed that the straight lines drawn to mark the bisections passing through E and H and through Z and F, that is, EZB and HFC, are perpendicular | to ABCD, and the equal distances BZ and FC are the vertical axes of the cylinders, whose bases are equal in diameter to the straight line AB. Then if we stretch from A to D a string AEHD, made of sinew and of a suitable length, EH will be parallel to ABCD, and EBCH will be a rectangle, because EB and HC are also equal and parallel, since

[122D]

⁵⁵⁷ This implies that distance AB amounts to half the width of the *kanōn*. Since Porphyry has just said that three finger-breadths would be a suitable size for AB, we can infer that the *kanōn* itself is about six finger-breadths wide. Porphyry does not explain the purpose of the circles, but it is probably to show the positions in which the two cylindrical bridges described below should be set up; see line 31.

ὡς τὴν ΑΕΗΔ, παράλληλος ἔσται ἡ ΕΗ τῇ ΑΒΓΔ καὶ παραλληλόγραμ-
μον τὸ ΕΒΓΗ, ὅτι καὶ αἱ ΕΒ ΗΓ ἴσαι τε καὶ παράλληλοί εἰσι κάθετοι
οὔσαι πρὸς τὴν ΒΓ. λήψεται δὲ <κατά> τὰ Ε καὶ Η σημεῖα τὰς ἀρχὰς τῶν ἀπο-
(5) ψαλμάτων· κατ' αὐτῶν γὰρ ἡ ΕΗ χορδὴ ἐφάπτεται τῶν κυρτῶν ἐπι-
φανειῶν διὰ τὸ τὰς ΖΕ καὶ ΘΗ ἐκ κέντρων τῶν κυρτοτήτων καθέτους
εἶναι καὶ πρὸς τὴν ΕΗ.

- Κατασκευάσαντες δὴ καὶ ἄλλο κανόνιον λεπτότερον μὲν τοῦ πρώτου
καὶ στενωτέρον, ὀλίγον δὲ μείζον τῷ μήκει τῆς ΕΗ χορδῆς καὶ μεταβάλ-
(10) λοντες ἐπ' αὐτοῦ τὸ ΕΗ μήκος ὡς τὸ ΜΝ, καὶ τούτου τὸ τῆς διχοτομίας
σημεῖον τὸ Γ θέντες· τοῦ δὲ ΜΓ μήκους τὸ τῆς διχοτομίας τὸ Δ ληψό-
μεθα καὶ τῆς ΕΗ χορδῆς τὴν διχοτομίαν, οἷον τὸ Κ· καὶ ἔτι τὴν τῆς
ἡμισείας διχοτομίαν ὡς τὴν Λ. πρόχειρον γὰρ τοῦτο γίνεται ἐκ τοῦ τὴν
μὲν ΜΝ τοῦ κανονίου ἐφαρμόζεσθαι τῇ ΕΗ, τὸ δὲ Δ πίπτειν κατὰ τὸ Λ
(15) καὶ τὸ Γ κατὰ τὸ Κ. ὄντων δὲ τούτων καταστήσομεν ὑπαγωγίδα
στενὰ πάνυ καὶ λεῖα, οἷον κεράτινα· ἢ μαγάδια ὑψηλότερα μὲν ἐκείνων
ὀλίγω, τῇ δὲ θέσει καὶ τῇ ὁμοιότητι πανταχόθεν ἀδιαφοροῦντα κατὰ τῆς
μέσης αὐτῶν τοῦ κυρτώματος γραμμῆς, ἥτις ὑπ' αὐτὴν ἔσται τὴν Κ τοῦ
κανόνος διχοτομίαν· ὅπως ἐὰν μὲν τὸ ΕΚ τῆς χορδῆς μέρος ἀπαράλ-
(20) λακτον εὐρίσκηται κατὰ τὴν τάσιν τῷ ΚΗ, καὶ πρὸς τοῦτο δὲ δῆλον
ἡμῖν ὑπάρχει τὸ ἰσόπυκνον αὐτὴν εἶναι καὶ ἰσοπαχεῖ καὶ ξηρὰν ὁμοίως·
κἂν δὲ μὴ οὕτως ἔχη, μεταφέρομεν τὴν δοκιμασίαν ἐπ' ἄλλο μέρος τῆς
χορδῆς αὐτῆς ἢ τὴν χορδὴν ἄλλην ἐκβάλλοντες τὴν πρώτην ὡς ἀποίητον
οὔσαν, ἄχρις ἂν ἐκ τῆς δοκιμασίας τὸ ἀκόλουθον διασωθῇ· τουτέστιν
(25) ἵνα τὰ ἴσα μήκη καὶ ὅμοια ὄντα καὶ μίαν ἔχοντα τάσιν ὁμότονα ᾖ πλησ-
σόμενα χωρὶς.

Ἔπειτα τοῦ τοιούτου καταληφθέντος καὶ διαιρεθέντος τοῦ λεπτοτέρου
κανονίου ἐν τοῖς εἰρημένοις τῶν συμφωνιῶν λόγοις, τουτέστι τῆς ΜΝ
εὐθείας, εἰς τὸν λόγον <τῆς ΜΞ πρὸς τὴν ΞΝ ἐπίτритον> τοῦ διὰ τεσ-

4 <κατά> add. Höeg (1934) 9 μεταβαλόντες G 10 αὐτοῦ Alexanderson αὐτῇ codd.
13 τοῦτο Düring τούτου codd. 17 κατὰ Alexanderson καὶ codd. 20 τούτω G
21 ἰσοπαχεῖ scripsi ἰσοπληγῇ codd. 22 ἔχοι G μεταφέρωμεν G 23 τὴν^{prim.}] τίνα conī.
Alexanderson ἐκβάλλοιμεν conī. Düring 29 <τῆς ΜΞ πρὸς τὸν ΞΝ ἐπίτритον> add. Wallis ubi
τόν in τὴν mut. Alexanderson

they are perpendicular to BC; and at points E and H it [the string AEHD] will have the beginnings of its plucked sections. | For it is at these points that the string EH touches the convex surfaces, since ZE and FH, running from the centres of the convexities, are perpendicular also to EH.

We now prepare another *kanonion*,⁵⁵⁸ lighter and narrower than the first, but a little longer than the string EH, and we transfer | the length EH to it, as MN, and mark the bisection of it as G. We shall then mark D,⁵⁵⁹ the bisection of the length MG, and K, the bisection of the string EH, and again L, the bisection of its half. This is easy to do by aligning the *kanonion* MN with EH, since D coincides with L, | and G with K. Once these things are done we shall set up thin, smooth *hypagōgidia*,⁵⁶⁰ made for instance of horn, or bridges a little higher than the others, but not differing in their position or in their similarity in every direction around the line through the centre of the convexity, which lies under K, the bisection of the *kanōn*; so that if part EK of the string is found to be | equal in pitch with KH, it will also be clear to us that it is of equal density and equal thickness⁵⁶¹ to the latter and has the same degree of dryness. And if this is not so, we transfer the test to another part of the same string, or to another string, discarding the first one as useless, until the proper result emerges from the test. This is done | so that equal lengths, being similar and having the same tension, should be equal-toned when they are struck separately.

When this has been achieved, the lighter *kanonion* – that is, the straight line MN – is divided into the ratios of the concords that have been specified – <MX to XN in the epitritic> ratio of the fourth, | 4:3; MO to

⁵⁵⁸ Literally a 'little *kanōn*'. It is not a second musical instrument, but the flat measuring-rod that Ptolemy calls by the same name. Porphyry says 'another' *kanonion* because the item is just as much a *kanōn* as is the first; a *kanōn* is in the first instance a ruler used for making measurements and drawing straight lines. The word's use to designate the monochord is a transference from that origin, based primarily on the fact that it is marked out in the manner of a straight ruler, and only secondarily on its capacity for 'measuring' musical intervals.

⁵⁵⁹ Porphyry here re-uses the letter delta, which appeared in the description of the *kanōn* itself, and in this case I have transliterated directly. It is of course not the same D as the first, but there need be no confusion, since the original D does not figure in this phase of the discussion.

⁵⁶⁰ *Hypagōgidion* is the diminutive of *hypagōgion*, which I have translated in Ptolemy's text as 'blade'. The reference is to a narrow bridge with flat vertical surfaces and a fairly sharp upper edge, analogous to those on modern stringed instruments; it is contrasted with the cylindrical bridges with (hemi-)spherical tops (*magades* or *magadia*) that are mentioned previously and again below. In other texts the noun *hypagōgeus*, cognate with *hypagōgion*, refers to a bridge without implying any distinction between types.

⁵⁶¹ The MSS reading, *isoplegē*, seems to mean 'struck equally', which would not suit the context. Conceivably it might mean 'striking equally', to be interpreted in the sense 'making the same impact' on the air, and so producing the same pitch; but even this would be inappropriate here, since the term should designate a feature of the string's physical constitution. I suggest *isopachē*, 'of equal thickness', as at 121.5 above; cf. also e.g. Nicom. *Harm.* 6.

- (30) σάρων δ' πρὸς γ', καὶ εἰς τὸν τῆς ΜΟ πρὸς ΟΝ ἡμιόλιον τοῦ διὰ πέντε γ' πρὸς β', καὶ πάλιν εἰς τὸν τῆς ΜΠ πρὸς τὴν ΠΝ διπλάσιον τοῦ διὰ πασῶν β' πρὸς α', καὶ εἰς τὸν τῆς ΜΡ πρὸς ΡΝ λόγον ἡ' πρὸς γ' τοῦ διὰ πασῶν καὶ διὰ τεσσάρων, <καὶ εἰς τὸν τῆς ΜΣ πρὸς ΣΝ λόγον γ' πρὸς α' τοῦ διὰ πασῶν καὶ διὰ πέντε,> καὶ εἰς τὸν τῆς ΜΤ πρὸς τὴν ΤΝ
- (123) λόγον δ' πρὸς α' τοῦ δις διὰ πασῶν καὶ διὰ τῶν ΞΟΠΡΣΤ σημείων πρὸς ὀρθὰς ἀχθειςῶν τῇ ΜΝ τῶν ΞΦ ΟΩ ΠΨ ΡΧ ΣΦ ΤΥ καὶ τῶν

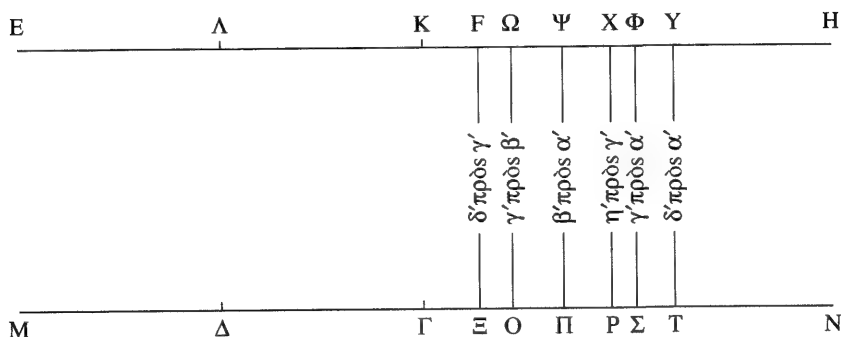


Figure 2G

- οἰκείων λόγων ἐπ' αὐτῶν γραφομένων, τουτέστιν ἐπὶ μὲν τῆς ΞΦ δ' πρὸς γ', ἐπὶ δὲ τῆς ΟΩ γ' πρὸς β', ἐπὶ δὲ τῆς ΠΨ β' πρὸς α', ἐπὶ δὲ τῆς ΡΧ ἡ' πρὸς γ', ἐπὶ δὲ τῆς ΣΦ γ' πρὸς α', ἐπὶ δὲ τῆς ΤΥ δ' πρὸς α'· καὶ διὰ τὸ εὐσύννοπτον εὐρήσομεν προχείρως ἐκ τῆς ὑφ' ἑκαστον τμήμα τοῦ μαγαδίου παραγωγῆς ὁμολογουμένης ταῖς ἀκοαῖς ἐπὶ τὸ ἀκριβέστατον ὥς φησι τὰς τῶν οἰκείων φθόγγων διαφοράς. ἐφαρμοσθείσης γὰρ τῆς ΜΝ τοῦ κανόνος ἐπὶ τὴν ΕΗ χορδὴν, καὶ ἐὰν ὥς τέμνεται ἡ ΓΝ εὐθεῖα ὑπὸ τῶν ΞΟΠΡΣΤ σημείων, οὕτω τὴν ΚΗ διέλωμεν
- (15) ἐξάκις δηλονότι εὐσήμου διδασκαλίας ἕνεκα αὐτῶ τῶ Κ ὅτε μὲν εἰς τὸν τῶν δ' πρὸς τὸν γ' λόγον, ὅτε δ' εἰς τὸν τῶν γ' πρὸς τὸν β', ὅτε δ' εἰς τὸν τῶν β' πρὸς α', ὅτε δ' εἰς τὸν τῶν ἡ' πρὸς γ', ὅτε δ' εἰς τὸν τῶν γ' πρὸς α', ὅτε δ' εἰς τὸν τῶν δ' πρὸς α' ὁ τῆς ΕΚ πρὸς ΚΗ λόγος ἔσται ὅτε μὲν δ' πρὸς γ', ὅτε δὲ γ' πρὸς β', ὅτε δὲ β' πρὸς α', ὅτε δ' ἡ' πρὸς γ', ὅτε δὲ γ' πρὸς α', ὅτε δὲ δ' πρὸς α'. ὥστε καὶ ὁ μὲν ἀπὸ τῶν δ' [λόγος] πρὸς τὰ γ' φθόγγος τῆς ΕΚ πρὸς ΚΗ ποιήσῃ τὸ διὰ τεσσάρων ἐν ἐπιτρίτῳ λόγῳ, ὁ δ' ἀπὸ τῶν γ' πρὸς τὰ β' τὸ διὰ πέντε ἐν ἡμιολίῳ
- (20)

30 ΜΟ Düring M codd. ON Düring OE codd 31 τὴν Alexanderson τόν codd. 33-4 <καὶ - πέντε> add. Wallis 34 τὴν Alexanderson τόν codd.

2 ΣΨ] Σ g 8 ΠΨ τρία codd. 9 ἡ' πρὸς γ'] δ' πρὸς γ' codd. 11 παραγωγῆς Wallis παραγωγῶν codd. 21 [λόγος] seclusi

ON in the hemiolic ratio of the fifth, 3:2; MP to PN in the double ratio of the octave, 2:1; MR to RN in the ratio 8:3, that of the octave and a fourth; <MS to SN in the ratio 3:1 of the octave and a fifth;> and MT to TN in the ratio 4:1 of the double octave. Then lines XW, OQ, PJ, RV, SU and TY are drawn through X, O, P, R, S, T, at right angles to MN, and the appropriate ratios are written on them – that is, 4:3 on XW, 3:2 on OQ, 2:1 on PJ, 8:3 on RV, 3:1 on SU and 4:1 on TY – | and because this is easy to take in at a glance, by shifting the bridge under each division we shall readily find, as Ptolemy says, that the differences between the relevant notes agree most accurately with the hearing.⁵⁶²

[123D]

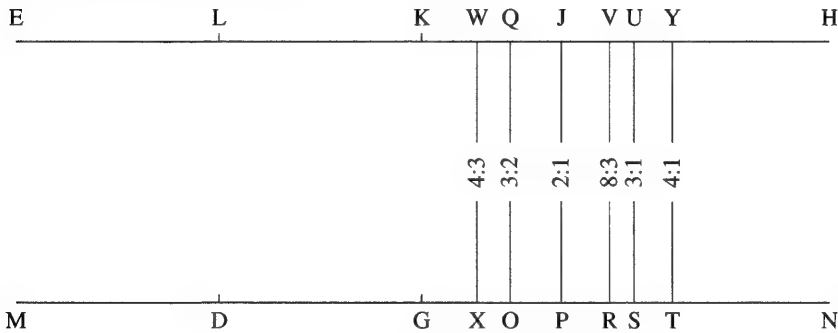


Figure 2 (variant of the one in the MSS)

For if MN is aligned with the *kanōn*'s string EH, and if as the straight line GN is divided by points X, O, P, R, S, T, so we divide KH | six times (to elucidate the exposition, this is done, obviously, by means of K itself⁵⁶³), to make, successively, the ratios 4:3, 3:2, 2:1, 8:3, 3:1 and 4:1, then the ratio of EK to KH will be, successively, 4:3, 3:2, 2:1, 8:3, | 3:1 and 4:1. Thus the note EK in relation to KH, produced from the ratio 4:3, will make the fourth in epitritie ratio, that from 3:2 will make the fifth in hemiolic ratio,

⁵⁶² As Alexanderson saw, the whole of this paragraph, despite Düring's odd punctuation, is one enormous sentence. I have broken it up to make it more readily intelligible. In the MSS of the figure that follows, the ratios are written along the bottom, below the lower set of figures, and there are no lines joining the upper letters to the lower. I have reorganised the diagram for the sake of clarity. The ratios are those between the distances to the left and right of the relevant points on EH and MN.

⁵⁶³ The length KH which is to be divided is initially the same length as it was before, half the length of the string. But now K, in the guise of the movable bridge, will be moved successively to each of the positions marked by the division; and with the moves listed as they are below, KH will become progressively shorter. This is the sense in which the division is done 'by means of K itself', as becomes clear in the sequel and is made explicit at lines 28–9. In adopting the strategy of making K move rather than introducing another set of letters, Porphyry follows Ptolemy's own treatment; it reflects the fact that K represents the same item, the bridge, at each of the relevant positions.

- λόγω, ὁ δ' ἀπὸ τῶν β' πρὸς τὸ α' ποιήσῃ τὸ διὰ πασῶν ἐν διπλασίῳ
 λόγῳ, ὁ δ' ἀπὸ τῶν η' πρὸς τὰ γ' ποιήσῃ τὸ διὰ πασῶν καὶ διὰ τεσσά-
 (25) ρων ἐν ἐπιμερεῖ λόγῳ τῷ ὃν ἔχει τὰ η' πρὸς τὰ γ', ὁ δ' ἀπὸ τῶν γ' πρὸς
 τὸ α' τὸ διὰ πασῶν καὶ διὰ πέντε ἐν τριπλασίῳ λόγῳ· ὁ δ' ἀπὸ τῶν δ'
 πρὸς τὸ α' ποιήσῃ τὸ δις διὰ πασῶν ὁμόφωνον ἐν τετραπλασίῳ λόγῳ·
 <τοῦ λόγου> ΕΚ πρὸς ΚΗ καθ' ἕκαστον εἰλημμένον ὡς αὐτὸς ὑπέθετο.
 καὶ τῷ Κ μηκέτι διχοτομεῖται ΕΗ χορδῇ. ἐξ ὧν ἀπάντων φαμέν ὡς τοὺς
 (30) μείζοντας τῶν ἀριθμῶν ἐφαρμοστέον ταῖς μείζουσι τῶν ἀποχῶν. γίνεται
 γὰρ ὡς ἡ μείζων ἀποχὴ πρὸς τὴν ἐλάσσονα, ὁ ἀπὸ τῆς ἐλάσσονος ἀποχῆς
 ψόφος ὀξύτερος ὢν πρὸς τὸν ἀπὸ τῆς μείζονος ὄντα βαρύτερον, ὡς καὶ
 προϊόντος τοῦ λόγου δείξει.

(124)

θ'

Τοῖς μὲν δὴ Πυθαγορείοις ἐκ τούτων οὐ περὶ τῆς εὐρέσεως τῶν
 ἐν ταῖς συμφωνίαις λόγων μεμπτέον, ἀληθεῖς γάρ, ἀλλὰ περὶ τῆς αἰτιο-
 λογίας αὐτῶν, δι' ἣν ἐκπίπτουσι τοῦ προκειμένου, τοῖς Ἀριστοξενείοις
 δέ, ἐπεὶ μήτε τούτοις ἐναργῶς ἔχουσι συγκατέθεντο, μήτε εἴπερ ἡπί-
 [20] στουν αὐτοῖς, τοὺς ὑγιεστέρους ἐζήτησαν, εἴ γε θεωρητικῶς ὑπισχνοῦντο
 προσενηνέχθαι μουσικῇ.

- Κέχρηται μὲν γὰρ τοῖς αὐτῶν λόγοις καὶ αὐτός, τουτέστι τῷ ἐπιτρίτῳ
 καὶ τῷ διπλασίῳ καὶ τοῖς λοιποῖς λόγοις. Μέμφεται δ' αὐτοῖς περὶ τῆς
 (5) αἰτιολογίας αὐτῶν, δι' ἣν ἐκβάλλουσι τὴν διὰ πασῶν καὶ διὰ τεσσάρων
 συμφωνίαν ἐναργῇ δειχθεῖσαν, καὶ ὅτι συμφωνοτέρας ἔλεγον εἶναι ταύ-
 τας, ἐφ' ὧν ἐλάττονα ἦν τὰ παραλειπόμενα ἀνόμοια μετὰ τὴν ἀφαίρεσιν
 τῆς μονάδος καθ' ἕκαστον τῶν λόγων τῶν ἐλαχίστων ἀριθμῶν ὑποτι-
 θεμένων, ὡς ἀνωτέρω εἴρηται. μέμφεται δὲ καὶ τοῖς Ἀριστοξενείοις,
 (10) ὅτι οὔτε τοῖς λόγοις τούτοις τῶν συμφωνιῶν ἐναργῶς ἔχουσι συγκατέ-
 θεντο, οὔτε μὴν ἀπιστήσαντες αὐτοῖς τοὺς ἀκριβεστέρους ἐζήτησαν, εἴ
 γε μετὰ τοῦ προσήκοντος λόγου ὑπισχνοῦντο προσενηνέχθαι μουσικῇ
 φησιν.

τὸ μὲν γὰρ τὰ τοιαῦτα πάθη ταῖς ἀκοαῖς
 παρακολουθεῖν ἐκ τοῦ πῶς ἔχειν τοὺς φθόγγους πρὸς ἀλλήλους ἀναγ-
 καῖον αὐτοῖς ἐστὶν ὁμολογεῖν, καὶ προσέτι τὸ τῶν αὐτῶν ἀντιλήψεων
 ὠρισμένας καὶ τὰς αὐτὰς εἶναι διαφοράς. [5]

25 ἐπιμερεῖ Wallis ἐπιμορίῳ codd. 28 <τοῦ λόγου> add. Düring τῆς ΕΚ πρὸς ΚΗ καθ' ἕκαστον
 λόγον εἰλημμένης g 29 τῷ Κ μηκέτι Alexanderson τῷ Κ ἔτι Wallis et Düring τὸ Κ μηκέτι codd.
 33 τέλος τοῦ η' κεφαλαίου add. g

1 ὅτι οὐ δεόντως Ἀριστοξενεῖοι τοῖς διαστήμασι καὶ τοῖς φθόγγοις παραμετροῦσι τὰς συμφωνίας add.
 V¹⁸⁷ ἐξήγησις εἰς τὸ τοῖς μὲν δὴ πυθαγορείοις G ἀρχὴ τοῦ θ' κεφαλαίου τοῖς μὲν δὴ . . . αὐτῶν καὶ τὰ
 ἐξῆς p 13 φησιν scripsi φασιν codd.

that from 2:1 will make the octave in double ratio, that from 8:3 will make the octave and a fourth | in the epimeric ratio which 8 has to 3, that from 3:1 will make the octave and a fifth in triple ratio, and that from 4:1 will make the double octave in quadruple ratio. The ratio of EK to KH is in each case constructed as Ptolemy laid down, and the string EH is no longer divided in half by K. On the basis of all this, we assert that | one must correlate the greater numbers with the greater distances. For as the greater distance is to the smaller, so is the sound from the smaller distance, which is higher, to that from the greater distance, which is lower, as he will show as the discussion proceeds.⁵⁶⁴

Chapter 9

This shows, then, that we should not find fault with the Pythagoreans in the matter of the discovery of the ratios of the concords, for these are correct, but in that of the investigation of their causes, which has led them astray from the objective; but we should find fault with the Aristoxenians, since they neither accepted these ratios, clearly established though they are, nor, if they lacked confidence in them, did they seek more satisfactory ones – if indeed they were genuinely committed to the theoretical study of music. Ptol. *Harm.* 19.16–20.2 [124D]

Ptolemy too used the same ratios as they [the Pythagoreans] did, that is, the epitritic and the double and the rest. He finds fault with them over | their investigations of the causes, which led them to reject the octave and a fourth, and also because they said that those concords in which the ‘dissimilars’ remaining after the subtraction of a unit from each term are smaller, when the ratios are taken in the smallest numbers, are the more concordant, as has been said above. But he finds fault with the Aristoxenians, | because they did not accept these ratios of the concords, clearly established though they are, nor, if they lacked confidence in them, did they seek more satisfactory ones – if indeed, he says, they were genuinely committed to studying music through appropriate reasoning.

For they must necessarily agree that such experiences come to the hearing from a relation that the notes have to one another, and further that where the impressions are the same, the differences are determinate and the same. Ptol. *Harm.* 20.2–5

⁵⁶⁴ The points made in last two sentences seem oddly placed here. They have been thoroughly dealt with in I.3; in this passage and subsequently Ptolemy simply takes them for granted. The final sentence also seems implicitly to assume that pitch-differences are themselves quantitative, as Ptolemy maintained in I.3, but as Porphyry strenuously denied. I think it quite likely that the sentences have intruded into the text from a reader’s marginal note. For comment on the remarkable features of 121.17–123.33 see Introduction Section 5(b).

- (15) Λέγει οὖν ὁ Ἀριστόξενος ἐν τῷ πρώτῳ τῶν Ἀρμονικῶν Στοιχείων περὶ τῶν συμφωνιῶν κατὰ λέξιν οὕτως.
 “Ἐπεὶ δὲ τῶν συμφωνιῶν πλείους εἰσὶ πρὸς ἀλλήλας διαφοραί, ὧν μία τις ἡ γνωριμωτάτη αὐτῶν, πρώτη ἐγκείσθω· αὕτη δ’ ἐστὶν ἡ κατὰ μέγεθος. ἔστω δὴ τῶν συμφωνιῶν ὀκτὼ μεγέθη, ἐλάχιστον μὲν τὸ διὰ
 (20) τεσσάρων. συμβαίνει δὴ τοῦτο τῇ αὐτοῦ φύσει ἐλάχιστον εἶναι· σημεῖον δὲ τὸ μελωδεῖν μὲν ἡμᾶς πολλὰ τοῦ διὰ τεσσάρων ἐλάττω, πάντα μέντοι διάφωνα. δεύτερον δὲ τὸ διὰ πέντε, ὃ τι δ’ ἂν τούτων ἀνὰ μέσον ἢ μέγεθος, πᾶν ἐστὶ διάφωνον. τρίτον <δ’> ἐκ τῶν εἰρημένων συμφώνων σύνθετον τὸ διὰ πασῶν· τὰ δὲ τούτων ἀνὰ μέσον διάφωνα εἶναι
 (25) λέγομεν. ταῦτα μὲν οὖν παρὰ τοῖς ἔμπροσθεν παρελήφαμεν. περὶ δὲ τῶν λοιπῶν αὐτοῖς ἡμῖν διοριστέον. πρῶτον μὲν δέικνυται, ὅτι πρὸς τῷ
 (125) διὰ πασῶν πᾶν σύμφωνον προστιθέμενον διάστημα τὸ γινόμενον ἐξ αὐτῶν μέγεθος σύμφωνον ποιεῖ. καὶ ἔστιν ἴδιον πάθος τοῦ συμφώνου τούτου· καὶ γὰρ ἐλάσσονος προστεθέντος καὶ ἴσου καὶ μείζονος τὸ γενόμενον ἐκ τῆς συνθέσεως σύμφωνον γίνεται. τοῖς δὲ πρώτοις συμφώνοις
 (5) <οὐ> συμβαίνει τοῦτο· οὔτε γὰρ τὸ ἴσον ἐκατέρῳ αὐτῶν συντεθὲν τὸ ὅλον σύμφωνον ποιεῖ, οὔτε τὸ ἐξ ἐκατέρου αὐτῶν καὶ τοῦ διὰ πασῶν συνημμένον, ἀλλ’ αἰεὶ διαφωνήσκει τὸ ἐκ τῶν εἰρημένων συμφώνων συγκείμενον. τόνος δ’ ἐστὶν, ᾧ τὸ διὰ πέντε τοῦ διὰ τεσσάρων μέζον.”
 ταῦτα μὲν οὖν ὁ Ἀριστόξενος.

πῶς δὲ ἔχουσι καθ’ ἕκαστον [5]

εἶδος οἱ ποιοῦντες αὐτὸ δύο φθόγγοι πρὸς ἀλλήλους, οὔτε λέγουσιν οὔτε ζητοῦσιν, ἀλλ’ ὥσπερ αὐτῶν ἀσωμάτων μὲν ὄντων, τῶν δὲ μεταξὺ σωμάτων, τὰς διαστάσεις τῶν εἰδῶν μόνας παραβάλλουσιν, ἵνα τι δόξωσιν ἀριθμῶ καὶ λόγῳ ποιεῖν.

- (II) Πῶς δ’ ἔχουσι καθ’ ἕκαστον εἶδος ἢ τῶν συμφωνιῶν ἢ τῶν ἄλλων ἐμμελῶν οἱ ποιοῦντες αὐτὸ τὸ εἶδος δύο φθόγγοι πρὸς ἀλλήλους, οὔτε λέγουσιν, οὔτε ζητοῦσιν, ἐξ ὧν παρεθέμεθα, ἀλλ’ ὥσπερ αὐτῶν μὲν τῶν

17 ἀλλήλας] ἀλληλα Aristox. ὧν om. Aristox. 18 πρώτη om. codd. Aristox. ἐκείσθω Aristox.
 22 διάφωνα] διάφορα p^{V187} 23 ἐστὶ] ἔσται cod. H Aristox. εἶναι ceteri <δ’> add. Marquard
 24–5 εἶναι λέγομεν] ἔσται cod. H Aristox. εἶναι ceteri 25 λέγομεν] λεγόμενα p^{V187} post οὖν add.
 λέγομεν ἃ codd. Aristox. τοῖς] τῶν Aristox. 26 ἡμῖν αὐτοῖς Aristox. δέικνυται] δειχθήσεται G
 οὖν λεκτέον Aristox. τῷ] τὸ p

2 ante πάθος add. τοῦτο τὸ Aristox. 2–3 τούτου Aristox. τοῦτο codd. 3–4 γενόμενον] λεγόμενον codd. Aristox. 5 <οὐ> add. Aristox. ἐκατέρῳ Aristox. ἐκότερον codd. 6 ἐκατέρου Aristox. αὐτοῦ ἐκότερον codd. post αὐτῶν add. δις τεθέντος Marquard 7 αἰεὶ διαφωνήσκει cod. H Aristox. ἢ διαφωνήσκει ceteri

| In the first book of the *Harmonic Elements* Aristoxenus speaks about the concords in precisely the following words.

Since there are several distinctions between concords, of which one is the best known, let us take it first; it is the distinction in respect of magnitude. Let there then be eight magnitudes of concords; the smallest is the | fourth. The fact that it is the smallest arises from its own nature;⁵⁶⁵ an indication of this is that we sing many intervals smaller than the fourth, but they are all discordant. The second is the fifth; whatever magnitudes there may be between them are discordant. The third is the one put together from the concords mentioned, the octave, and we say that those between them [sc. the fifth and the octave] | are discordant. These are points we have inherited from our predecessors, but we ourselves must define the remainder. It is shown, first,⁵⁶⁶ that every concordant interval when added to the octave makes the magnitude arising from them concordant. This is an attribute peculiar to this concord [the octave]; for when one that is smaller or equal or greater is added, what arises from the combination is concordant. With the first two concords | this is not the case, for the addition to either of them of one equal to it does not make the whole concordant, and nor does either if it is added to the one composed of itself and the octave, but the result of the combinations of concords mentioned will always be discordant. The tone is that by which the fifth is greater than the fourth.⁵⁶⁷

[125D]

That is what Aristoxenus says.

| Yet in what relation, in the case of each species <of concord>, the two notes that make it stand to each other, they neither say nor enquire, but as if the notes were bodiless while what lies between them were bodies, they compare only the sizes of the species, in order to appear to be doing something with number and reason. Ptol. *Harm.* 20.5–9

In what relation,⁵⁶⁸ in the case of each of the species either of the concords or of the melodics, the two notes that make the species stand to each other, they neither say nor enquire on the basis of what we have set out, but as

⁵⁶⁵ 'Its own nature' is also in the MSS of Aristoxenus, but modern editors insert the noun *melous* into Aristoxenus' text, giving the sense 'the nature of melody itself', in correspondence with a parallel statement at 21.11–14.

⁵⁶⁶ The Aristoxenus MSS give 'We must say first'.

⁵⁶⁷ Aristox. *El.harm.* 45.3–46.1. On the attribution of this passage to the first book of the *Harmonic Elements* cf. 81.23 above with n. 318.

⁵⁶⁸ At this point Düring comments: 'textus Porphyrii abhinc paraphrasis magis quam commentarii formam praebet'. This is not entirely fair, but it is true that the amount of independent input from Porphyry diminishes sharply in the remainder of the commentary. A reader suggests that this may reflect a regular practice among teachers, that of working in depth with students on the first part of a text, and then moving more briskly through the remainder, on the grounds that they will by now have acquired the skills they need in order to interpret it for themselves. This may indeed have been a common practice; but in this case Porphyry's change of strategy is more probably motivated by the steep reduction, from this chapter onwards, in the philosophical content of Ptolemy's text.

- φθόγγων ἀσωμάτων ὄντων, τῶν δὲ μεταξύ σωμάτων, τὰς διαστάσεις
- (15) τῶν εἰδῶν μόνας παραβάλλουσιν, ἵνα τι δόξωσιν ἀριθμῶ καὶ λόγῳ ποιεῖν.
- Ὡς γὰρ ἐν τοῖς προγραφομένοις εἰρήκαμεν, οἱ Ἀριστοξένειοί φησι τὰ τῶν διαστημάτων μεγέθη λέγεσθαι κατὰ τὴν ἀπόστασιν τῶν ὀξυτάτων καὶ βαρυτάτων, ἀλλ' οὐ κατὰ τὴν τοῦ μείζονος πρὸς τὸ ἔλασσον ὑπεροχήν· οὐδὲ λόγον τινὰ ἀριθμῶν τῆς τῶν φθόγγων πρὸς ἀλλήλους σχέσεως
- (20) λέγουσιν, ὥσπερ Πυθαγόρᾳ καὶ Πτολεμαίῳ δοκεῖ, ἀλλὰ τοπικὸν εἶναι τὸ διάστημα λέγουσιν, ὃν τρόπον ἐπὶ κιόνων ἢ καμπτήρων τὸ μεταξύ διάστημα· ὅθεν καὶ ὁ Ἀριστόξενος ὥρισατο τὸ μεταξύ [καὶ] δύο φθόγγων ἀνομοίων τῇ τάσει λέγων εἶναι διάστημα, διὸ καὶ μεγέθει γνωρίζεσθαι πάντως. καὶ ἐν τῷ τετάρτῳ Περὶ μελοποιΐας
- (25) φαίνεται δοκιμάζων τόνον καὶ δηλονότι τῶν ἰβ' μονάδων ὑποτιθέμενος ὡς ἐλάχιστον ὄντα τῶν ἐχόντων ἥμισυ καὶ τρίτον καὶ τέταρτον διὰ τὴν
- (126) τοῦ τόνου εἰς γ' καὶ δ' καὶ ζ' διαίρεσιν, ἣ προϊόντος τοῦ λόγου φανερὰ γενήσεται.
- Ἔστι δὲ πᾶν τούναντίον. πρῶτον μὲν γὰρ οὐχ ὀρίζονται τοῦτον τὸν τρόπον καθ' αὐτὸ τῶν εἰδῶν ἕκαστον οἷόν ἐστιν, ὥσπερ ὅταν πυνθανομένων ἡμῶν, τί ἐστι τόνος, εἴπωμεν, ὅτι διαφορὰ δύο φθόγγων ἐπόγδοον περιεχόντων λόγον ἢ τί ἐστι διὰ τεσσάρων, εἴπωμεν, δύο φθόγγων διαφορὰ ἐπίτριτον περιεχόντων λόγον. ἀλλ' εὐθύς ἀναφορὰ γίνεται πρὸς ἄλλο τι τῶν μὴ ὠρισμένων, ὥσπερ ὁ Ἀριστόξενος ὥρισατο τὸν τόνον ὑπεροχὴν τοῦ διὰ πέντε πρὸς τὸν διὰ τεσσάρων, μὴ ὠρισάμενος,

22 [καὶ] del. Düring 26–126.1 τὴν τοῦ τόνου εἰς γ' καὶ δ' καὶ ζ' Düring τὸν Γ EN codd.

1 vide supra ad 125.26.

if the notes themselves were bodiless and the things between them bodies, they compare only the sizes⁵⁶⁹ | of the species, in order to appear to be doing something with number and reason.

For as we have said in our previous comments, Ptolemy says that the Aristoxenians speak of the sizes of the intervals on the basis of the distance between the highest and lowest notes, and not on the basis of the excess of the greater over the smaller, nor do they speak of the ratio of numbers proper to the mutual relation between | the notes, as was the policy of Pythagoras and Ptolemy, but they say that the interval is spatial, like the interval between pillars or turning-posts.⁵⁷⁰ Hence Aristoxenus defined the interval as 'that which lies between two notes that differ in pitch',⁵⁷¹ so that they are recognised exclusively by their size. And in the fourth book of his *On Melodic Composition*⁵⁷² | it is evident that when assessing the tone he posits that it is of 12 units, since 12 is the smallest of the numbers that have a half and a third and a quarter, because of the division of the tone into three and four and six, as will become clear as the discussion proceeds.⁵⁷³

[126D]

But the truth is precisely the opposite. For in the first place they do not define in this way what each of the species is in itself (in the way in which, if we | were asked what a tone is, we would say that it is the difference⁵⁷⁴ between two notes that comprise an epogdoic ratio, or if asked what a fourth is, we would say that it is the difference between two notes that comprise an epitritie ratio). Instead they immediately shift to another item that is not defined; in this way Aristoxenus defined the tone as the excess of the fifth over the fourth⁵⁷⁵ without having defined | what the fifth

⁵⁶⁹ Ptolemy's term, echoed by Porphyry, is *diastaseis*, 'distances', referring to the distance between the notes from which each species of concord is formed. Elsewhere I have generally used 'distances' in the translation, but here it would make for awkward English.

⁵⁷⁰ That is, the turning-points on a race-course. ⁵⁷¹ Paraphrasing *El. harm.* 15.24–5.

⁵⁷² The work is not mentioned by any other source, or not under this title.

⁵⁷³ Alexanderson rejected Düring's reconstruction of the badly damaged text at 125.26–126.1 ('of the tone into three and four and six'), on the grounds that it must be the octave that is divided into twelve units. This is a mistake. The Aristoxenians did indeed divide the octave into twelve half-tones, for certain purposes. But Aristoxenus also makes use of a division of the tone into twelfths. He did not mean that such intervals can be used in melody, but they figure in theoretical analysis when the sizes of small intervals are compared; he mentions them three times in the course of *El. harm.* 25.14–28, for precisely the reason implied by Düring's reconstruction.

⁵⁷⁴ This expression is quoted directly from Ptolemy (*Harm.* 20.11–12). The 'difference' (*diaphora*) is that between the terms of a ratio, but it is conceived in the way usually signalled by the word 'excess' (*hyperochē*), as such-and-such a fraction of the smaller term.

⁵⁷⁵ See *El. harm.* 21.22–3, 45.35–46.1. Here and sometimes below, the word 'excess' (*hyperochē*) is used in the Aristoxenian sense, to refer to the size, in musical terms, of the interval by which one interval exceeds another (e.g. as here, the 'excess' of the fifth over the fourth is a tone). This is of course quite different from the sense in which Ptolemy and Porphyry standardly use the word. For brevity's sake I call them the 'Aristoxenian' and the 'Porphyrian' excess in subsequent notes to this passage. Confusion can easily arise in contexts of this sort, since Porphyry rarely tells us explicitly which of them he has in mind.

- (10) τί ἐστι τὸ διὰ πέντε ἢ διὰ τεσσάρων, καίτοι τῆς αἰσθήσεως εἰ θέλει τόνον ἀρμόσασθαι μὴ δεομένης πρότερον τοῦ διὰ τεσσάρων ἢ τῶν ἄλλων τινός, ἀλλ' ἱκανῆς οὔσης ἐκάστην τῶν ἐπογδῶν διαφορὰν συστήσασθαι καθ' αὐτήν, ὡς ἐν τῇ κιθαρωδίᾳ. κἂν ἐπιζητῶμεν δὲ τὸ μέγεθος τῆς λεγομένης ὑπεροχῆς, οἷον τοῦ τόνου, οὐδ' αὐτὴν ἀποφαίνουσι χωρὶς
- (15) ἄλλης συμφωνίας, ἀλλὰ μόνον ἂν εἴποιεν, εἰ τύχοι δύο τοιούτων, οἷων ἢ τοῦ διὰ τεσσάρων πέντε, καὶ ταύτην πάλιν τοιούτων πέντε, οἷων ἢ τοῦ διὰ πασῶν δεκαδύο, καὶ παραπλησίως ἐπὶ τῶν λοιπῶν, ἕως ἂν τραπῶσιν ἐπὶ τὸ λέγειν, οἷων ἢ τονιαία δύο. ἔπειτα οὐδ' οὕτως τὰς ὑπεροχὰς ὀρίζουσι τῶν διαστάσεων.
- (20) Λέγει δ', ὅτι κἂν συγχωρηθῶσι λέγειν, οἷων ἢ τονιαία δύο, οὐδ' οὕτως αἰεὶ ἔσονται αἱ ὑπεροχαὶ ἴσαι· λόγων γὰρ εἴσι ὑπεροχαί, οἱ δ' οὐ χρω-
ται τούτοις.

**ἄπειροι τοίνυν συναχθήσονται καθ' ἕκαστον λόγον
τῶν ποιούντων αὐτάς μὴ προσοριζομένων [25]**

- (25) Οἷον τοῦ ἡμιολίου καὶ τοῦ ἐπιτρίτου καὶ τοῦ διπλασίου. ἐν γὰρ τοῖς ὀξυτέροις φθόγγοις τῶν αὐτῶν διαστημάτων λαμβανομένων ἄνισα φαίνε-
ται τὰ διαστήματα, ὥσπερ τὴν ἀπὸ τῶν ἐμπνευστῶν ὀργάνων τῶν ποι-
ούντων αὐτὰ φθόγγων διαφορὰν λαμβανομένων. τὰ γὰρ ἐν τοῖς ὀξυτέ-

in lemmate: 20.24 τοίνυν] γάρ Ptol.

and the fourth are – despite the fact that if one wants to attune a tone, perception has no prior need of the fourth or any of the other <intervals> in advance, but is capable of constructing each of the epogdoics simply as such, as in *kitharōidia*. And if we enquire about the magnitude of the excess in question, the tone, for instance, they do not explain even this without reference to | another concord, but would say, perhaps, that it is two of those of which the fourth is five, and that this again is five of those of which the octave is twelve, and similarly for the rest, until they come back round to saying ‘... of which the tone is two’. Secondly, they do not define the differences in the intervals even in this way.⁵⁷⁶ | Ptolemy means that even if they were permitted to say ‘of which the tone is two’, their excesses would still not always be equal.⁵⁷⁷ For they are excesses belonging to ratios, and of these the Aristoxenians make no use.

There will turn out to be infinitely many of them in each ratio if the things that make them are not defined first. Ptol. *Harm.* 20.24–5

| <This applies> for instance to the hemiolic, the epitritic and the double. For when the same *diastēmata* are constructed in the higher notes, the *diastēmata* turn out to be unequal,⁵⁷⁸ just as in the difference when the notes that make the intervals are constructed on wind instruments.⁵⁷⁹ For

⁵⁷⁶ In this paragraph and repeatedly in the rest of the text, Porphyry incorporates into his discussion lightly supplemented or modified quotations of passages in Ptolemy which do not appear independently in his lemmata. Here the passage is *Harm.* 20.9–23. Nothing in Ptolemy’s text has been omitted except the final words of the last statement (missing also from the next lemma, where the whole statement would more naturally be placed); in Ptolemy they read ‘because they do not relate them to the things to which they belong’. Porphyry’s additions are as follows: the explicit indication that it is ‘we’ who are asked at 126.5; the question and answer about the fourth at 126.6–7; the references to Aristoxenus at 126.8, to the epogdoics at 126.12, to *kitharōidia* at 126.13, to a concord at 126.15 and to intervals (*diastaseis*) at 126.19.

⁵⁷⁷ This must be the ‘Porphyrian’ excess, the difference between a ratio’s terms conceived as a fraction of the smaller term. In the (very polemical) sequel, however, both Porphyry and Ptolemy make much of the fact that the absolute numbers assigned to the terms are not the same when the interval is taken between higher notes as it is when taken between lower notes, and hence the excess of the greater number over the smaller will be different too. In this ‘absolute’ sense (which is neither the ‘Aristoxenian’ kind nor the regular ‘Porphyrian’ one) the ‘excesses’ involved in the ratios of two equal intervals will not always be the same. It will be clear, however, that this fact is irrelevant to the identity of an interval in mathematical harmonics, and equally irrelevant in a critique of Aristoxenus, in whose work these ratios play no part.

⁵⁷⁸ The passage that follows shows that the first instance of *diastēmata* in this sentence means ‘musical intervals’, and the second refers to ‘intervals’ or ‘distances’ between points on a string or a pipe. An argument against Aristoxenus which exploits ambiguities involved in references to ‘intervals’, ‘distances’ and ‘differences’ is pursued through the rest of this section.

⁵⁷⁹ The syntax (from ‘just as...’) is odd, and I am not sure that my translation is accurate. The point must be, however, that when notes are produced on wind instruments, equal intervals in different pitch-ranges are not produced by equal differences in the effective sounding-lengths. Thus if three successive finger-holes are spaced at the same distance apart, the interval between the notes from the first and the second will not be equal to that between the notes from the second and third.

- (30) ροις διαστήματα, οὔσι δὲ τοῖς αὐτοῖς, ἀνισα φαίνεται, οἷον ἐν ἀριθμῷ
 ἰβ' τοῦ ζ' διὰ πασῶν ἀλλὰ καὶ ὁ ζ' τοῦ γ'. καὶ ἐπὶ μὲν τοῦ πρώτου διὰ
 πασῶν ἡ διάστασις ζ', ἐπὶ δὲ τοῦ δευτέρου γ'.

ὥς διὰ τοῦτο μηδὲ τὰς τὸ διὰ πασῶν εἰ τύχοι ποιούσας διαστάσεις

- (127) ἐν ταῖς ὀργανοποιΐαις τηρεῖσθαι τὰς αὐτάς, ἀλλ' αἰετὰς ἐν ταῖς ὀξυτέ-
 ραις τάσεσι συνίστασθαι βραχυτέρας. παραβαλλομένων γοῦν ἀλλήλαις
 τῶν ἴσων συμφωνιῶν κατὰ τὰ ἕτερα τῶν περάτων, οὐκ ἴση πάντοτε
 ἔσται τῆς ὑπεροχῆς ἡ διάστασις, ἀλλ' ἔαν μὲν τοὺς ὀξυτέρους φθόγγους
 (5) αὐτῶν ἐφαρμόζωμεν ἀλλήλοις, μείζων, ἔαν δὲ τοὺς βαρυτέρους, ἐλάττων.
 ὑποτεθείσης γὰρ τῆς AB διαστάσεως τοῦ διὰ πασῶν, ἐν αὐτῷ τοῦ A
 νοουμένου ὥς φησι κατὰ τὸ ὀξύτερον πέρας, καὶ ληφθειῶν δύο τοῦ διὰ
 πέντε, μιᾶς μὲν ἀπὸ τοῦ A ἐπὶ τὸ βαρὺ, ὡς τῆς ΑΓ, ἐτέρας δ' ἀπὸ τοῦ B
 ἐπὶ τὸ ὀξύ, ὡς τῆς ΒΔ, ἔσται ἄρα ἐλάττων ἡ μὲν ΑΓ διάστασις τῆς ΒΔ,
 (10) ἡ δ' ΑΔ ὑπεροχὴ τῆς ΒΓ.

- Εὐλόγως· ἐπεὶ γὰρ ἐκάτερα τῶν ΑΓ ΔΒ διαστάσεων διὰ πέντε ἐστὶ
 καὶ ἡ μὲν ΑΓ τῆς ΔΒ κατ' ὀξυτέρων πέπτωκε τάσεων, μείζων ἐστὶν ἡ
 ΔΒ διάστασις τῆς ΑΓ διαστάσεως· κοινὴ ἀφηρήσθω ἡ ΔΓ. λοιπὴ ἄρα
 ἡ ΒΓ ὑπεροχὴ τῆς ΑΔ μείζων. ἀπλῶς οὖν τῷ διπλασίῳ λόγῳ δεῖ
 (15) χρῆσθαι καὶ τῷ ἡμιολίῳ καὶ οὐ διοίσει ἡ ὑπεροχὴ. ἔαν γὰρ ἀπὸ τοῦ ἰβ'
 πρὸς ζ' λόγῳ διπλασίῳ λάβωμεν ἐπὶ τὸ ὀξύ διὰ πέντε τὸν η' καὶ ἀφέλω-
 μεν τὸν τῶν ἰβ' πρὸς η' λόγον ἡμιόλιον, καταλείπεται λόγος ἐπίτριτος
 τῶν η' πρὸς τὰ ζ'. καὶ ἄλιν ἔαν <ἀπό> τοῦ ἐτέρου ὅρου τῶν ζ' λάβω-
 μεν ἐπὶ τὸ βαρὺ διὰ πέντε, τάξαντες μέσον ὅρον τῶν ἰβ' καὶ <τῶν ζ'> τὸν θ' ἀριθ-
 (20) μόν, καὶ ἀφέλωμεν ὁμοίως τὸν τῶν θ' πρὸς τὰ ζ' λόγον ἡμιόλιον, λεί-
 πεται λόγος ἐπίτριτος. οὐ διήνεγκεν ἄρα ἡ ὑπεροχὴ τῶν λόγων καθ'
 ἕκαστον ἐπίτριτος οὖσα. αὐτῶν δὲ τῶν ὅρων διήνεγκε· τρία γὰρ καὶ
 δύο αἱ ὑπεροχαί.

1 ante ἐγ^{sec}. add. αὐτάς p 2 παραλαμβανομένων V¹⁸⁷ 3 ἴσων e Ptol. ἀνισων codd.
 5 μείζων – ἐλάττων V¹⁸⁷ ἐλάττων – μείζων g 9 ἐλάττων e Ptol. μείζων codd. 10 ante ἡ
 δὲ ΑΔ <μείζων δὲ ἡ ΒΓ ὑπεροχὴ τῆς ΑΔ> add. Düring ΒΓ scripsi ΓΔ codd. 18 τῶν^{prim}. τοῦ g
 <ἀπό> add. Düring τοῦ ἐτέρου ὅρου Düring τῷ ἐτέρῳ ὅρῳ codd. τῶν ζ' Alexanderson τῶν η' codd.
 19 τῶν ἰβ' καὶ <τῶν ζ'> τὸν θ' scripsi <τῶν ζ' καὶ> τῶν ἰβ' τὸν θ' Alexanderson τὸν ἰβ' καὶ τὸν θ' codd.
 et Düring 22 τρία γὰρ Düring καὶ γάρ codd.

the *diastēmata* in the higher notes, though they are the same, turn out to be unequal.⁵⁸⁰ For instance, the octave is in the number | 12 in relation to 6, but also in the number 6 in relation to 3; in the first octave the distance (*diastasis*) is 6, but in the second it is 3.

For this reason, <Ptolemy says>, not even the distances making the octave, for example, in instrument-making are kept the same, but are always made shorter in the higher pitches. Thus if equal concords are based on different terms, the distance constituting the excess will not always be equal, but if we attune to one another those of | the notes that are higher it will be smaller, and if we attune the lower ones it will be greater. For if we posit that the distance AB in it is an octave, where A is thought of, as he says, as the higher limit, and take two fifths, one downwards from A – call it AC – and the other upwards from B – call it BD – the distance AC will be smaller than BD, | and the difference AD will be smaller than BC.⁵⁸¹

[127D]

This stands to reason. For since each of the distances AC and DB is a fifth, and AC falls on higher pitches than DB, the distance DB is greater than AC. Let DC, which is common to them, be subtracted; the result is then that the remainder BC is greater than AD. One should therefore make use of the double ratio | and the hemiolic as such, and the remainder will not differ. For if from the 12, related to 6 in the double ratio, we take a fifth upwards, to 8, and subtract the hemiolic ratio 12:8 [sc. from the octave span 12:6], what is left is the epitritie ratio 8:6. And if again from the other boundary we take a fifth downwards, placing the middle term, the number 9, between 12 and 6, | and if in the same way we subtract the hemiolic ratio of 9:6, what is left is the epitritie ratio. Then the excess in the ratios does not differ in the two cases, since each is epitritie, though the excesses of the terms themselves do differ; for the differences are 3 and 2.⁵⁸²

⁵⁸⁰ Grammatically, 'they' must be the notes, but as the following example shows, Porphyry must have intended to refer to the *diastēmata*, in the sense 'distances' between points on a string or 'differences' between pairs of numbers (whereas the *diastēmata* explicitly mentioned in this sentence are musical intervals).

⁵⁸¹ The paragraph is quoted from *Harm.* 20.25–21.8, with the minor additions of 'in it' (which is slightly mysterious) at 127.6, and 'as he says' at 127.7, and the omission of Ptolemy's 'because it falls between higher pitches' after 'smaller than BD' at 127.9. At 127.5, Düring follows the better MSS in reading 'greater' and 'smaller' in the opposite order, as he does at the same point in Ptolemy (*Harm.* 21.2). This must be wrong, as the subsequent sentences show.

⁵⁸² The first instance of 'excess' in this sentence is 'Porphyrian', and the second is of the 'absolute' type mentioned in n. 577 above. The whole argument from 126.20 to 127.23, closely following Ptol. *Harm.* 20.23–21.8, is ridiculous as a criticism of Aristoxenus and his followers. Of course it is true that the difference between lengths of a string or pipe which give the same interval in different ranges of pitch will not be equal. But the 'distances' (*diastēmata*) which the Aristoxenians envisaged are not lengths on an instrument; they have no truck whatever with such things, and they never try to correlate musical intervals with such lengths in the way that Ptolemy and Porphyry imply. Their *diastēmata* are 'distances' in the dimension of pitch and in no other.

- Καὶ ὅλως δ' ἄτοπώτατον δόξειεν ἄν, εἰ τὰς μὲν ὑπεροχὰς λόγου τινὸς
(25) ἀξιοῦν, μὴ δεικνυμένου δι' αὐτῶν τοῦ λόγου τῶν ποιούντων αὐτὰς μεγε-
θῶν, τὰ δὲ μεγέθη μηδενός, ἀφ' ὧν καὶ τὸν ἐκείνων εὐθύς ἔνεστιν ἔχειν.

- Αὗται αἱ ὑπεροχαὶ ποιοῦσι διαφωνίας ἢ συμφωνίας, ἀλλ' αἱ σχέσεις
τῶν φθόγγων ἐν μεγέθει τυγχάνουσαι ποιοῦσι τοὺς λόγους. οὐ γὰρ
ἀσώματοι εἰσιν οἱ φθόγγοι ὥσπερ σημεῖα, ἀλλ' οἷονεὶ μεγέθη τινά. πῶς
(30) γὰρ ὑπεροχὰς ἔχουσιν ἀμεγέθεις ὄντες; ἄτοπον μὲν οὖν ἔστι τὰς μὲν
ὑπεροχὰς λόγου τινὸς ἀξιοῦν, ἐπεὶ μὴ δυνατόν ἐστι δι' αὐτῶν καὶ τὸν
(128) λόγον εὑρεῖν τῶν ποιούντων αὐτὰς μεγεθῶν, τὰ δὲ μεγέθη αὐτὰ τῶν
φθόγγων μηδενός ἀξιοῦν λόγου, ἀφ' οὗ δοθέντος καὶ ὁ τῶν ὑπεροχῶν
εὐθύς δοθήσεται.

- Εἰ δὲ μὴ τῶν ἐν τοῖς φθόγγοις ὑπεροχῶν φήσαιεν εἶναι τὰς παραβολὰς
(5) —τουτέστι τῆς ὀξύτητος καὶ τῆς βαρύτητος — λέγοντες τὸ διάστημα οὐκ
ἔστιν ὑπεροχή, ἀλλὰ τὸ ὑπὸ δύο φθόγγων περιεχόμενον, τίνων ἄλλων
εἰσὶν ὑπεροχαί, οὐκ ἂν ἔχοιεν εἰπεῖν. οὔτε γὰρ διάστασις τις κενὴ καὶ

27 ποιοῦσι Høeg (1934) ποιοῦσαι codd.

29 σημεία] σῆμα p

And in general it would seem utterly absurd to think that the excesses have a ratio | when the ratio between the magnitudes that make them is not demonstrated, and to think that the magnitudes, from which one can immediately derive their ratio too, have none.⁵⁸³ The excesses themselves make discords or concords,⁵⁸⁴ but the relations between the notes, which are quantitative, make the ratios. For the notes are not bodiless, like points, but are as it were magnitudes. For how | can they have excesses if they are without magnitude? It is therefore absurd to think that the excesses have a ratio, since it is not possible even to discover through them the ratio of the magnitudes that make them,⁵⁸⁵ while thinking also that the magnitudes of the notes have no ratio, though when it is given that of the excesses will immediately be given too.

[128D]

And if they were to deny that the comparative relations (between height and depth, that is) are those of the excesses of the notes (saying that an interval | is not an excess, but that which is bounded by two notes), they would be unable to say of what other things they are excesses.⁵⁸⁶ For the

⁵⁸³ Quoted from Ptol. *Harm.* 21.9–11. Despite the scarceness in Aristoxenian sources of direct allusions to ratios, it is arguably correct to say that in their type of theory there is a ratio between an 'Aristoxenian' excess and each of the intervals between whose sizes it is the difference. The fact is disguised by their practice of expressing the relations as fractions rather than explicitly as ratios. Thus the excess of the fifth over the fourth is one tone; given the Aristoxenian theses that the fifth is $3\frac{1}{2}$ tones and the fourth is $2\frac{1}{2}$ tones, the ratio of the fifth to the excess is 7:2 and of the fourth to the excess is 5:2.

⁵⁸⁴ This intriguing statement (in which the excesses are 'Porphyrian') refers back to the thesis expounded at 118.3–12 above, where the degree of an interval's concordance or melodicness is made to depend on the relation in which the difference between the terms of the interval's ratio stands to the smaller term. It is this relation that determines the interval's musical quality, while it is the ratio between the terms that defines its size.

⁵⁸⁵ Here the excess seems to be 'Porphyrian', since the second part of the sentence shows that it is the excess of one note over another, where the notes are treated as magnitudes; it cannot be an 'Aristoxenian' excess, since that is the difference between two intervals. But then if the first part of the sentence is intended as a straightforward statement of fact it is clearly false; if we know by what fraction of the smaller term the greater term exceeds it, we can immediately infer the size of the ratio. Porphyry seems to understand that perfectly well (see 88.17–27 above, and cf. 136.2–3 below). Probably he is simply expanding the point made a few lines earlier at 126.24–6, and means only that the inference becomes impossible if, as the next clause says, the notes are not treated as magnitudes which stand in some ratio to one another. (This is of course irrelevant as a criticism of the Aristoxenians; and even if 'excess' is understood in their sense, the first part of the sentence is still false. If we know that the ratio of the smaller interval to the excess is 5:2, for instance, it immediately follows that the ratio between the two intervals is 7:5.)

⁵⁸⁶ For consistency's sake I retain 'excess' as a translation of *hyperochē* in this paragraph, though it makes for very unnatural English ('difference' would be clearer, but would obscure these statements' connection with earlier parts of the discussion). The point here is that the Aristoxenians deny that an interval is the 'excess' of one quantity over another. Porphyry and Ptolemy are right to imply that the Aristoxenians used the term *hyperochē*, but that they did not equate it with *diastēma*, 'interval'. From their perspective, an interval, simply as such, involves no 'excess' of one thing over another, even though one interval, as we have seen, can 'exceed' another by some amount. It is true that this 'amount' will itself be some interval, but its being an interval is independent of its role as an 'excess'.

- μῆκος μόνον ἐστὶ τὸ σύμφωνον καὶ τὸ ἐμμελές, οὔτε σωματικὸν μὲν,
 ὅπερ συνεχῇ τοῖς σώμασιν ἔχει καὶ τὴν δύναμιν καὶ τὴν ὕπαρξιν, ἐνός
 (10) δέ τινος ἀπλῶς κατηγορεῖται—τοῦ μεγέθους—ἀλλὰ δύο τῶν πρώτων
 μεγεθῶν καὶ τούτων ἀνίσων, τουτέστι τῶν ποιούντων αὐτὰ ψόφω,
 ὥστε τὰς κατὰ τὸ ποσὸν παραβολὰς τῆς ὀξύτητος καὶ βαρύτητος μη-
 δενὸς ἄλλου δυνατὸν εἶναι φάσκειν, εἰ μὴ τῶν φθόγγων ἐν μεγέθει θεω-
 ρουμένων καὶ τῶν ὑπεροχῶν αὐτῶν, ὧν οὐδέτερα ποιοῦσιν οἱ Ἀριστοξέ-
 (15) νειοὶ γινώριμα τῇ τε φύσει συνωρισμένα καὶ λόγου κοινοῦ τετυχηκότα,
 διπλασίου ἢ ἄλλου φέρε λόγου, καθ' ὃν ἓνα καὶ τὸν αὐτὸν ὄντα δείκνυται
 πῶς ἔχουσιν οἱ φθόγγοι πρὸς ἀλλήλους θ' ἅμα καὶ τὴν ὑπεροχὴν,
 μίαν καὶ τὴν αὐτὴν οὔσαν καὶ ἐν τοῖς ἐλαχίστοις ἀριθμοῖς τῶν λόγων
 θεωρουμένων· οὐ γὰρ δύο εἰσὶ καθάπερ ἐδείχθη διὰ γραμμῆς ἀπὸ τοῦ
 (20) ὀξυτέρου τῶν φθόγγων ἐπὶ τὸν βαρύτερον ἢ διάστασις ἐλάσσων τῆς
 ἀπὸ τοῦ βαρυτέρου ἐπὶ τὸν ὀξύτερον καὶ ἡ ΒΓ ὑπεροχὴ τῆς ΑΔ μείζων.

ι'

Τοιγάρτοι διαμαρτάνουσι καὶ περὶ τὴν τῆς ἐλαχίστης καὶ πρώτης
 συμφωνίας καταμέτρησιν, συντιθέντες αὐτὴν ἐκ δύο τόνων καὶ ἡμίσεος,
 ὥστε τὴν διὰ πέντε συνάγεσθαι τριῶν καὶ ἡμίσεος τόνων, τὴν δὲ διὰ
 πασῶν ἕξ τόνων καὶ τῶν ἄλλων ἐκάστην κατὰ τὸ ταύτης ἀκόλουθον.
 ὁ γὰρ λόγος ἀξιοπιστότερος ὢν ἥδη τῆς αἰσθήσεως ἐν ταῖς οὕτω βρα- [25]
 [22] χυτάταις διαφοραῖς ἐλέγχει τοῦτο οὕτως μὴ ἔχειν, ὥς ἔσται δῆλον.
 αὐτοὶ μὲν οὖν πειρῶνται τὸ προκείμενον δεικνύνειν οὕτως. ἔστωσαν
 γὰρ δύο φθόγγοι διὰ τεσσάρων συμφωνοῦντες οἱ Α Β, καὶ ἀπὸ μὲν τοῦ
 Α δίτονον εἰλήφθω ἐπὶ τὸ ὀξύ τὸ ΑΓ, ἀπὸ δὲ τοῦ Β ὁμοίως ἐπὶ τὸ βαρὺ
 δίτονον εἰλήφθω τὸ ΒΔ· ἐκότερον ἄρα τῶν ΑΔ καὶ ΓΒ ἴσον ἐστίν, καὶ
 τηλικούτον ᾧ ἐλλείπει τὸ δίτονον τοῦ διὰ τεσσάρων.

- (23) Δεῖ πρῶτον ὑποδεῖξαι, πῶς οἱ Ἀριστοξένειοι τὸ διὰ τεσσάρων δει-
 κνύουσι δύο καὶ ἡμισυ τόνων, ἔπειτα τὴν λέξιν αὐτὴν σαφηνίσαι. ἔστω-
 (25) σαν δύο φθόγγοι διὰ τεσσάρων συμφωνοῦντες οἱ Α καὶ Β· τοῦτο δ' ἐκ
 τηρήσεως τῇ αἰσθήσει τῆς ἀκοῆς κατελάβομεν ὥς ἐν τῇ κιθάρᾳ. καὶ
 ἀπὸ μὲν τοῦ Α δίτονον εἰλήφθω ἐπὶ τὸ ὀξύ, τὸ ΑΓ· καὶ τοῦτο δ' ἐκ

13 φάσκειν] φάσκειν typographico errore Düring
 κεφαλαίου add. p

21 τέλος τοῦ θ' κεφαλαίου add. p ἀρχὴ τοῦ ι'

concordant or the melodic is not just some empty distance or mere length, nor is it bodily (an attribute which preserves in bodies the continuity of their powers and existence) and predicated | of just one single thing, the magnitude,⁵⁸⁷ but of two primary magnitudes, which are unequal – that is, the magnitudes of the sounds that make them – so that it is not possible to say that the comparisons of height and depth in respect of quantity are of anything other than the notes, conceived as magnitudes, and of their excesses. Neither of these is made known and specified by the Aristoxenians | in accordance with its nature, and equipped with a definition that applies in all cases (as the double ratio, for example, or some other), a definition which displays it as one and the same, and shows how the sounds are related to one another and to the excess,⁵⁸⁸ which is one and the same even when the ratios are taken in their smallest terms. For there are not two of them, in the way it was shown previously, in a diagram, that the distance from the | higher of the notes downwards is smaller than that from the lower note upwards, and that the difference BC is greater than AD.⁵⁸⁹

Chapter 10

They are mistaken, furthermore, about the measurement of the first and smallest concord, composing it as they do from two tones and a half, so that the fifth is put together from three and a half tones, the octave from six tones, and each of the other concords in the way that follows from this one. For reason, which is more worthy of trust than perception in the case of such extremely small differences, proves that this is not so, as will be clear. They attempt to prove their proposition as follows. Let there be two notes, A and B, concordant at the fourth, and from A let a ditone, AC, be taken upwards; and from B, similarly, let a ditone BD be taken downwards. Then AD and CB are equal, and each is as great as is that by which the ditone is less than the fourth. Ptol. *Harm.* 21.21–22.6

We must show first how the Aristoxenians demonstrate that the fourth amounts to two and a half tones, and then clarify Ptolemy's statements themselves. Let there be | two notes, A and B, concordant at the fourth; we establish this through the ear's perceptual observation, as is done with a kithara. Let a ditone, AC, be taken upwards from A – this too is made

⁵⁸⁷ The magnitude referred to here is the size of an interval, as conceived by the Aristoxenians.

⁵⁸⁸ Quoted from Ptol. *Harm.* 21.11–20, with minor additions: the clauses in parentheses at 128.5–6, 128.9 and 128.16, the words 'just' at 128.10, 'magnitudes' at 128.11, 'of height and depth' at 128.12, 'conceived as magnitudes' at 128.13–14, 'the Aristoxenians' and 'specified in accordance with its nature' at 128.14–15.

⁵⁸⁹ The diagram is shown at Ptol. *Harm.* 21.3.

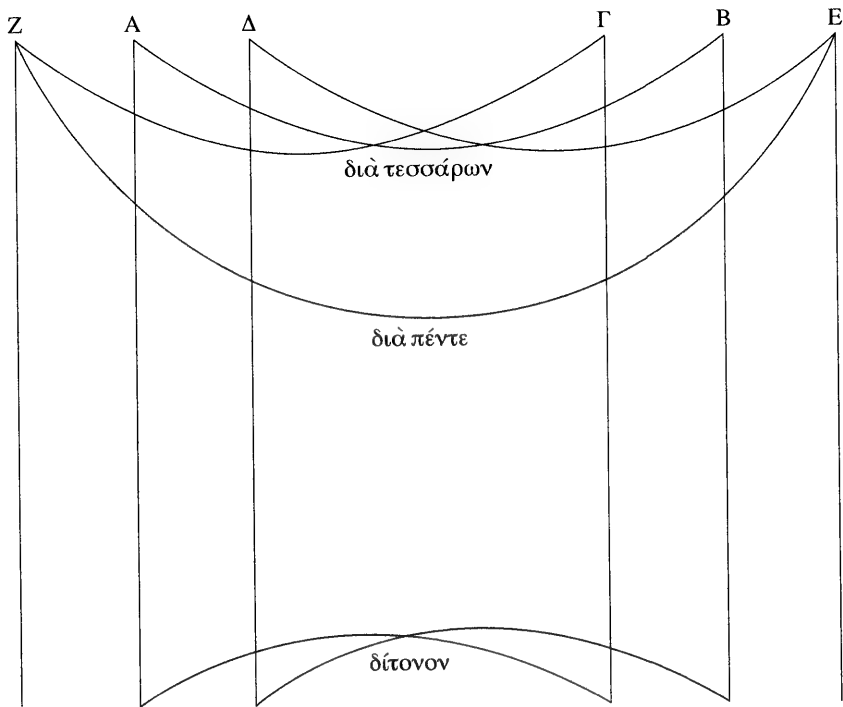


Figure 3G

τῆς ἀρμογῆς τῶν κιθαρῶδων αὐτῶν ἐγένετο δῆλον· ἀπὸ δὲ τοῦ Β ὁμοίως ἐπὶ τὸ βαρὺ δίτονον εἰλήφθω, τὸ ΒΔ· ἐκάτερον ἄρα τῶν ΑΔ καὶ

(30) ΓΒ ἴσον τ' ἐστὶ καὶ τηλικούτον, ᾧ ἐλλείπει τὸ δίτονον τοῦ διὰ τεσσάρων.

- (129) Πάλιν δὴ ἀπὸ μὲν τοῦ Δ διὰ τεσσάρων εἰλήφθω ἐπὶ τὸ ὀξύ τὸ ΔΕ, ἀπὸ δὲ τοῦ Γ ὁμοίως διὰ τεσσάρων ἐπὶ τὸ βαρὺ τὸ ΓΖ· ἐπεὶ τοίνυν ἴσον ἐστὶ τὸ ΑΒ τῷ ΓΖ· ἐκάτερον γὰρ διὰ τεσσάρων ἐστὶ· κοινὸν ἀφηρήσθω τὸ ΑΓ δίτονον· λοιπὸν ἄρα τὸ ΑΖ λοιπῷ τῷ ΓΒ ἴσον ἐστὶ.
- (5) πάλιν ἐπεὶ ἴσον ἐστὶ τὸ ΑΒ διάστημα τῷ ΔΕ· ἐκάτερον γὰρ διὰ τεσσάρων ἐστὶ· κοινὸν ἀφηρήσθω τὸ ΔΒ δίτονον· λοιπὸν ἄρα τὸ ΑΔ ἴσον ἐστὶ τῷ ΒΕ. ἐδείχθη δὲ καὶ τὸ ΑΔ ἐκατέρῳ τῶν ΖΑ ΓΒ ἴσον· τὰ τέσσαρα ἄρα τὰ ΖΑ ΑΔ ΓΒ ΒΕ ἴσα ἀλλήλοις ἐστίν, ἀλλὰ τὸ ΖΕ τήν

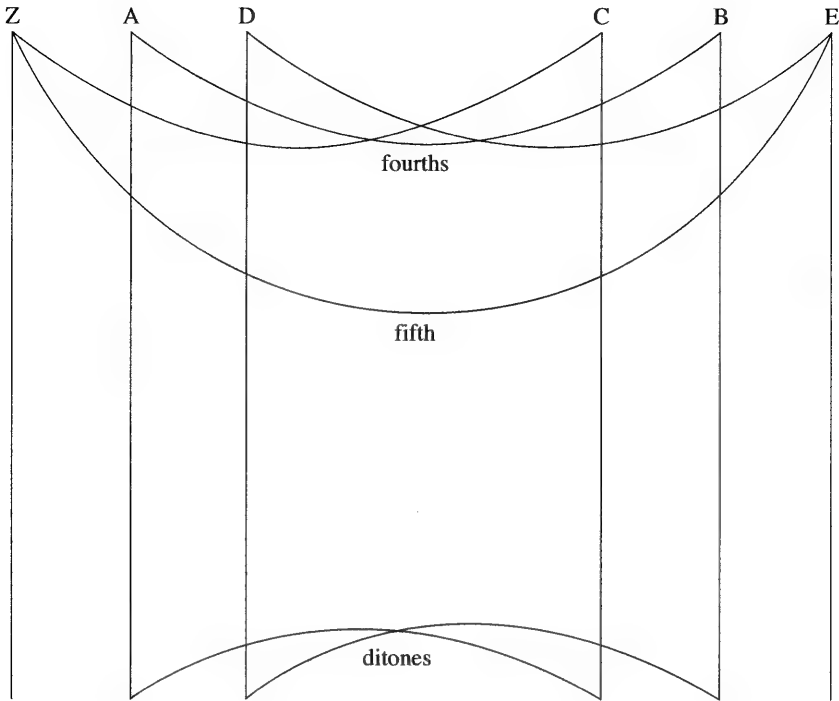


Figure 3

clear in the tuning-procedures of the *kitharōidoi*.⁵⁹⁰ Similarly, let a ditone, BD, be taken downwards from B. Then AD and | CB are equal, and each is as great as that by which the ditone is less than the fourth.⁵⁹¹

Again, let a fourth, DE, be taken upwards from D, and similarly, let a fourth, CZ, be taken downwards from C. Then since AB is equal to CZ, each being a fourth, let the ditone common to them, AC, be taken away. Then the remainder AZ is equal to the remainder CB. | Again, the interval AB is equal to DE, since each is a fourth. Let the ditone common to them, DB, be taken away; then the remainder AD is equal to BE. It is shown also that AD is equal to each of ZA and CB, and hence the four remainders ZA, AD, CB and BE are equal to one another. But they say that

[129D]

⁵⁹⁰ Porphyry specifies the kithara to emphasise that the procedure is carried out with an ordinary instrument, not with one such as the monochord, designed for the purpose of exact measurement. 'This too is made clear . . .': Porphyry means that the procedure of the *kitharōidoi* demonstrates how the ditone can be attuned by ear. The method which they and other musicians used for this purpose is described at Aristox. *El. harm.* 55.13–26, [Eucl.] *Sect. can.* prop. 17.

⁵⁹¹ Cf. Aristox. *El. harm.* 55.26–56.12.

- διὰ πέντε φασὶ ποιεῖν συμφωνίαν, ἐκ τηρήσεως πάλιν καταλαμβάνοντες,
- (10) ὅτι οἱ ΖΕ φθόγγοι τὴν διὰ πέντε συμφωνίαν ποιοῦσιν. ὥστ' ἐπεὶ τὸ μὲν ΑΒ διὰ τεσσάρων ἐστί, τὸ δὲ ΖΕ διὰ πέντε, ὑπεροχὴ δ' αὐτῶν ἐστὶ τόνος, ὡς Ἀριστόξενος ὑποτίθεται καὶ αὐτοὶ λέγουσι. τὰ ΖΑ καὶ ΒΕ ἄρα συναμφότερα καταλείπεται τόνου ἑνός· ἐκάτερον δ' αὐτῶν, τουτέστιν ἐκάτερον τῶν ΑΔ καὶ ΓΒ ἡμιτονίου· διτόνου δ' ἐστὶ καὶ τὸ ΑΓ,
- (15) ὥστε καὶ τὸ ΑΒ δύο καὶ ἡμίσεος συντίθεσθαι τόνων.

- Αὐτοὶ μὲν οὖν οὕτω πως ἔδειξαν τὸ προκείμενον τῇ αἰσθήσει κατακολουθήσαντες, ὥστε καὶ τὴν διὰ πέντε συμφωνίαν τριῶν καὶ ἡμίσεος ὑποτιθέναι τόνων, τὴν δὲ διὰ πασῶν ἑξ τόνων. ὁ δὲ λόγος ἀξιοπιστότερος ὢν ἤδη τῆς αἰσθήσεως ἐν ταῖς οὕτω βραχυτάταις διαφοραῖς ἐλέγχει
- (20) τοῦτο μὴ οὕτως ἔχον.
- Ἄπαξ γὰρ τοῦ τόνου δειχθέντος ἐπογδοῦ καὶ τοῦ διὰ τεσσάρων ἐπι- τρίτου δηλον αὐτόθεν γίνεται, καθ' ἃ καὶ Εὐκλείδης ἔδειξε καὶ Ὁπτολεμαῖος, τὸ τὴν ὑπεροχὴν, ἣ ὑπερέχει τὸ διὰ τεσσάρων τοῦ διτόνου, καλουμένην δὲ λείμμα, ἔλαττον εἶναι ἡμιτονίου. λαβὼν γὰρ ἀριθμὸν ἐλάχι-
- (25) στον τὸν δυνάμενον δεῖξαι οὐ τὸ λείμμα μόνον, ἐν ποίῳ λόγῳ ἐστίν, ἀλλὰ καὶ τὴν ὑπεροχὴν, ἣ ὑπερέχει τὸ τονιαῖον διάστημα τοῦ λειμματός. οὗτος δ' ὁ ἀριθμὸς ἐστὶ μονάδες αφλς'. τοῦτου μὲν ἐπόγδοον ἐκτίθεται τὸν αψκη', τοῦτου δ' ἔτι ἐπόγδοον τὸν α'λμδ', ὅς δηλονότι πρὸς τὸν τῶν αφλς' λόγον ἔξει διτόνου. ἔστι δὲ καὶ ἐπίτριτος τοῦ αφλς' ὁ τῶν βμῆ'.
- (30) τὸ ἄρα λείμμα ἐν λόγῳ ἐστὶ τῷ τῶν βμῆ' πρὸς τὰ α'λμδ'. ἀλλ' ἐὰν καὶ τούτων α'λμδ' τὸν ἐπόγδοον λάβωμεν, ἔξωμεν ἀριθμὸν τὸν τῶν βρπζ'· καὶ ἔστιν μείζων ὁ λόγος ὁ τῶν βρπζ' πρὸς τὰ βμῆ', καλούμενος ἀποτομή, τοῦ τῶν βμῆ' πρὸς τὰ α'λμδ'. τὰ μὲν γὰρ βρπζ' τῶν βμῆ' μείζονι μὲν ὑπερέχει ἢ τῷ πεντεκαιδεκάτῳ αὐτῶν μέρει,
- (130) ἐλάττονι δ' ἢ τῷ τεσσαρεσκαιδεκάτῳ. τὰ δὲ βμῆ' τῶν α'λμδ' μείζονι μὲν ὑπερέχει ἢ τῷ ἑννεακαιδεκάτῳ αὐτῶν μέρει, ἐλάττονι δ' ἢ τῷ ὀκτωκαιδεκάτῳ. τὸ ἔλασσον ἄρα τοῦ τρίτου τόνου τμήμα ἐντὸς ἀπειλήπται τοῦ διὰ τεσσάρων πρὸς τῷ διτόνῳ, ὥστε τὸ μὲν τοῦ λειμματός μέγεθος
- (5) ἔλαττον ἡμιτονίου συνάγεσθαι, τὸ δὲ διὰ τεσσάρων ὅλον ἔλασσον δύο καὶ ἡμίσεος τόνων. καὶ ἔστι τῷ τῶν βμῆ' πρὸς τὰ α'λμδ' λόγῳ ὁ αὐτὸς ὁ τῶν σνς' πρὸς τὰ σμγ'.

ZE makes the concord of a fifth, establishing through observation, once again, | that the notes Z and E make the concord of a fifth. Thus since AB is a fourth and ZE is a fifth, the excess of one over the other is a tone, as Aristoxenus postulates and they themselves say.⁵⁹² Then it follows that ZA and BE taken together amount to one tone, and each of them – and also each of AD and CB – amounts to a half-tone; and hence AC is a ditone, | so that AB is made up of two and a half tones.⁵⁹³

These people, then, guided by perception, demonstrated their proposition in roughly this way, so that they posited also that the concord of a fifth amounts to three and a half tones and the octave to six. But reason, which is more worthy of trust than perception in the case of such extremely small differences, proves | that this is not so.⁵⁹⁴

As soon as the tone has been shown to be epogdoic and the fourth epitritetic, it is immediately obvious, as Euclid⁵⁹⁵ and Ptolemy have shown, that the excess by which the fourth exceeds the ditone, called the *leimma*, is smaller than a half-tone. For taking the smallest number | capable of showing the ratio not only of the *leimma* but also of the excess by which the interval of a tone exceeds the *leimma*, which is of 1536 units, Ptolemy sets down its epogdoic as 1728, and the epogdoic of that as 1944, which will obviously have the ratio of a ditone to 1536. The epitritetic of 1536 is 2048; | hence the *leimma* is in the ratio of 2048 to 1944. But if we take also the epogdoic of 1944, we shall have the number 2187, and the ratio of 2187 to 2048, which is called the *apotomē*, is greater than that of 2048 to 1944. For 2187 exceeds 2048 by more than a fifteenth part of the latter, and less than a fourteenth part. But 2048 exceeds 1944 by more than a nineteenth part of the latter, and less than an eighteenth part. Hence the smaller section of the third tone is included within the fourth in addition to the ditone, so that the magnitude of the *leimma* | amounts to less than a half-tone, and the whole fourth to less than two and a half tones. And the ratio of 2048 to 1944 is the same as that of 256 to 243.⁵⁹⁶

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⁵⁹² 'They' are the Aristoxenians mentioned at the beginning of the chapter.

⁵⁹³ The first sentence of this paragraph and part of the second (up to 'each being a fourth') are quoted directly from Ptolemy (*Harm.* 22.6–9). The rest is an expanded paraphrase of *Harm.* 22.6–16. Ptolemy and Porphyry base their accounts of this demonstration on Aristox. *El. harm.* 56.13–58.5, where, however, the conclusion is more nuanced; it is said to follow *if* the interval which Porphyry calls ZE is perceived by the ear as a concord. No doubt Aristoxenus believed that it is, but he has left his readers to make their own judgements about it.

⁵⁹⁴ The last sentence is quoted from the passage in the lemma above.

⁵⁹⁵ [Eucl.] *Sect. can. prop.* 15, quoted above at 103.16–22.

⁵⁹⁶ The paragraph is quoted from Ptol. *Harm.* 22.17–23.18, with no significant changes of phrasing, except that Ptolemy's first sentence, unlike Porphyry's, states that it is reason that makes the proposition 'immediately obvious'. Porphyry has added the allusion to Euclid and Ptolemy at 129.22–3, and the words 'the ratio not only . . . exceeds the *leimma*' at 129.25–6 (where Ptolemy has merely 'the proposition').

- Ταῦτα μὲν οὖν φανερά. ποίᾳ δὲ χρησάμενος ἀγωγῇ τὸν ἀφλς' ἀριθ-
 μὸν ἔλαβεν, ἄξιον εἰπεῖν. ἐκθέμενος γὰρ τοὺς πυθμένους τοῦ ἐπογδόου,
 (10) τουτέστι τὸν ὀκτώ καὶ τὸν ἐννέα, ζητεῖ πάλιν καὶ τοῦ θ' δευτέρου ἀριθ-
 μοῦ ἐπόγδοον ἀριθμὸν καὶ εὐλόγως ποιεῖ τοὺς ἐκκειμένους ὀκτάκισ'
 ἐπεὶ οὐκ ἔχει ὁ θ' ὄγδοον· καὶ γίνεται ὁ τε ξδ' καὶ ὁ οβ'· καὶ ἔστι τοῦ
 οβ' ἐπόγδοος ὁ πα', ὡς εἶναι τοὺς ἐκκειμένους ἀριθμοὺς ξδ' οβ' πα'.
 καὶ ἐπειδὴ τὸ διὰ τεσσάρων δεῖ ἐκθέσθαι ἐν ἐπιτρίτῳ λόγῳ τοῦ ἄκρου
 (15) ἀριθμοῦ, τουτέστι τοῦ ξδ', δεῖ ἄρα τὸν ξδ' τρίτον ἔχειν· οὐκ ἔχει δέ.
 πάντα ἄρα τρισσῶς γινέσθω ρ'ιβ' σις' σμγ'. καὶ ἐπεὶ βουλόμεθα τὸν
 σμγ' πρὸς τινα ἕτερον ἀριθμὸν εὑρεῖν, δεῖ ἄρα τὸν σμγ' ὄγδοον ἔχειν·
 οὐκ ἔχει δέ. ἄρα ὀκτάκισ γίνονται οἱ ἀριθμοὶ ὁ ἀφλς' καὶ ὁ ρψκῆ' καὶ
 ὁ α'λμδ' [καὶ ὁ ,βρπζ']. καὶ ἔστι τοῦ α'λμδ' ἐπόγδοος ὁ ,βρπζ'. εἰσὶν
 (20) ἄρα οἱ ἀριθμοὶ οἱ αὐτοὶ τοῖς προειρημένοις. ἔλασσον ἄρα τὸ διὰ τεσσά-
 ρων δύο καὶ ἡμίσεος τόνων. [ξδ' οβ' πα']

- Τὴν δὲ τοιαύτην μάχην οὐ τοῦ λόγου πρὸς τὴν αἴσθησιν ὑποληπτέον,
 ὡς τῆς μὲν αἰσθήσεως εὐρούσης καθ' ἑαυτὴν τὸ διὰ τεσσάρων σύμφωνον
 τόνων δύο ἡμίσεος, τοῦ δὲ λόγου καταλαμβάνοντος αὐτὸ ἔλασσον ὃν δύο
 (25) ἡμίσεος τόνων, ὑποκειμένου δηλονότι τοῦ τονιαίου διαστήματος ἐν ἐπο-
 γδῳ εἶναι λόγῳ, ἀλλὰ τῶν διαφόρως ὑποτιθεμένων, τουτέστι τόνων
 δύο ἡμίσεος καὶ ἐν ἐπιτρίτῳ λόγῳ τὸ διὰ τεσσάρων. ἀμαρτίαν δὲ ἦδη
 τῶν νεωτέρων Ἀριστοξενείων, καὶ παρὰ τὴν αἴσθησιν καὶ τὸν λόγον.
 ἡ μὲν γὰρ αἴσθησις μονονουχὶ κέκραγεν ἐπιγινώσκουσα σαφῶς καὶ
 (30) ἀδιστάκτως τὴν τε διὰ πέντε συμφωνίαν ἐν ἡμιολίῳ λόγῳ λαμβανομένην

16 ρ'ιβ' σμγ' σνς' g post σμγ' add. σνς' V¹⁸⁷
 Düring

19 [καὶ ὁ ,βρπζ'] delevi

21 [ξδ' οβ' πα'] del.

These things are clear; but it is worth explaining the procedure he used in choosing the number 1536. After setting out the fundamental terms of the epogdoic, | 8 and 9, he then looks for the epogdoic of the second number, the 9; and for good reasons he multiplies the numbers that were set out by 8, since 9 has no eighth.⁵⁹⁷ The products are 64 and 72. The epogdoic of 72 is 81, so that the numbers are 64, 72, 81. And since the fourth must be set out in the epitritie ratio based on the first | number, 64, it is necessary for 64 to have a third; but it does not. So let them all be tripled, giving 192, 216, 243. And since we want to place 243 in relation to some other number,⁵⁹⁸ it is necessary for 243 to have an eighth; but it does not. So when multiplied by 8 the numbers become 1536, 1728, 1944;⁵⁹⁹ and the epogdoic of 1944 is 2187. These are | the same numbers as those mentioned previously, and hence the fourth is less than two and a half tones.⁶⁰⁰

One should not suppose that this sort of conflict is that of reason against perception (on the grounds that perception discovers by itself that the concord of a fourth is two and a half tones whereas reason grasps that it is less than two and | a half tones – given, obviously, that the interval of a tone is in epogdoic ratio), but that it is the fault of those who adopt inconsistent premises (that is, that the fourth is two and a half tones, and that it is in epitritie ratio), and is thus the fault of the more recent Aristoxenians, contrary to both perception and reason.⁶⁰¹ For perception virtually shrieks its clear and unmistakable | recognition of the concord of a fifth when it is

⁵⁹⁷ To find the epogdoic of 9 is to find the number that stands to it in the ratio 9:8, that is, the number that is nine eighths of 9. No whole number is one eighth of 9; hence the terms of the ratio must be multiplied in such a way that the larger term becomes one whose division by 8 yields a whole number. Multiplication by 8 is the obvious choice. Similar strategies are adopted throughout the paragraph.

⁵⁹⁸ Literally, 'to find 243 in relation to some other number'. I suspect that the text is defective, but I hesitate to suggest any particular emendation. The overall point must in any case be that we are to find the number which is the epogdoic of 243.

⁵⁹⁹ The MSS add 'and 2187'. This must be a scribal error, prompted by this number's occurrence in the next clause, since the only numbers appropriate here are the 8-times multiples of 192, 216 and 243.

⁶⁰⁰ The main argument to this effect was given in the previous paragraph, but it gave no justification for its use of these particular numbers. Porphyry's point here is that his explanation of their credentials removes any doubts that there might otherwise have been about the argument's soundness. For a rather similar discussion of numbers used by Ptolemy see 139.27–140.31 below.

⁶⁰¹ Porphyry interprets Ptolemy as blaming those who adopt *inconsistent* premises, rather than merely 'erroneous' ones, as I put it when translating Ptolemy in Barker (1989), and this is correct; he is also right in saying that Ptolemy is pointing the finger at the more recent Aristoxenians in particular. I cannot confidently identify any theorist of the relevant period who could fairly be described as an Aristoxenian, and who also accepted the propositions linking the fifth and the fourth with their ratios; but cf. 2.4.4–6 above with nn. 84–5 ad loc. There is no evidence that Aristoxenus himself accepted them, and he cannot be convicted of inconsistency on this score; the most that arguments based on ratio-theory can show is simply that he was wrong.

ἐπὶ τοῦ προειρημένου μονοχόρδου κανόνος καὶ τὴν διὰ τεσσάρων ἐν τῷ ἐπιτρίτῳ. οἱ δὲ νεώτεροι ταῖς τῆς αἰσθήσεως ὁμολογίαις οὐκ ἐμμένουσι, αἷς ἐξ ἀνάγκης ἔπεται τὸ τὴν ὑπεροχὴν τοῦ διὰ πέντε πρὸς τὸ διὰ τεσσάρων τονιαίαν οὔσαν ἐπὶ γόδοον περιέχειν λόγον, ὥ μείζων ἐστὶ καὶ ὁ

- (131) ἡμιόλιος λόγος τοῦ ἐπιτρίτου. διὰ τοῦτο δὲ καὶ τὴν διὰ τεσσάρων συμφωνίαν ἐλάσσονα συνίστασθαι δύο ἡμίσεος τόνων, ὡς ἀνωτέρω ἔδειξεν. ἀλλ' ἐν οἷς μὲν ἱκανὴ κρίναι πέφυκεν ἡ αἴσθησις, τουτέστιν ἐν ταῖς μείζουσι διαφοραῖς, ἀπιστοῦσιν αὐτῇ παντάπασι. τεθέντων γὰρ ἡμιολίων καὶ ἐπιτρίτων λόγων, ἐφ' ὧν καὶ αὐτοὶ συμφωνίας εἶναι λέγουσιν, οὐ συγκατατίθενται, ὅτι ἐν λόγοις εἰσὶν ἐν οἷς δ' οὐκέτι αὐτάρκης ἐστὶ, τουτέστιν ἐν ταῖς ἐλάττοσιν ὑπεροχαῖς πιστεύουσιν αὐτῇ, λέγοντες τὴν ὑπεροχὴν τοῦ διτόνου πρὸς τὸ διὰ τεσσάρων ἡμιτονιαῖον καὶ οὐ λείμμα. μᾶλλον δὲ προσάπτουσι κρίσεις ἐναντίας ταῖς πρώταις καὶ κυριωτέραις

- (10) τῶν λόγων, ἡμιολίου λέγω καὶ τοῦ ἐπιτρίτου.

Πρὸς δὲ τοῖς εἰρημένοις ὁ Πτολεμαῖος παραστήσαι βουλόμενος καὶ τὸ συμπέρασμα τῆς ἀποδείξεως αὐτῶν εὐηθες πάνυ καὶ οὐ γραμμικαῖς ἀνάγκαις συναγόμενον ἐπιλογίζεται τὸ μέγεθος τῆς τοῦ λείμματος πρὸς τὸ ἡμιτόνιον διαφορᾶς οὕτως.

- (15) Ἐπειδὴ γὰρ οὐδεὶς μὲν ἐπιμόριος εἰς ἴσους δύο λόγους διαιρεῖται διὰ τὸ ἐπιμορίου διαστήματος μηδένα μέσον ἀνάλογον ἐμπίπτειν ἀριθμόν, ὡς ἀνωτέρω ὑπεδείξαμεν ἴσοι δ' ἔγγιστα δύο λόγοι ποιοῦσι τὸν ἐπὶ γόδο-

constructed in hemiolic ratio on the monochord described above, and of the concord of a fourth when constructed in epitritric ratio. But the more recent theorists do not hold firmly to the premises on which perception agrees, from which it follows necessarily that the excess of the fifth over the fourth, which is the tone, comprises the epogdoic ratio by which the hemiolic ratio is greater than the epitritric. For this reason, too, the concord of a fourth is less than two and a half tones, as Ptolemy showed above. But in cases where perception is naturally competent to judge, that is, in respect of the greater differences, they distrust it altogether; for when hemiolic | and epitritric ratios are constructed – in which they themselves say that there are concords – they do not concede that they are in ratios.⁶⁰² But in cases where it is not sufficient by itself, that is, where the excesses are smaller, they do trust it, saying that the excess of the ditone over the fourth is a half-tone and not a *leimma*. Or rather, they bring to bear additional judgements opposed to the primary and more authoritative judgements | about the ratios – the hemiolic, I mean, and the epitritric.⁶⁰³

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Because Ptolemy wanted to show, in addition to what has been said, the naivety of the conclusion of their demonstration and the fact that it is not entailed by geometrical necessity, he calculates the size of the difference between the half-tone and the *leimma* as follows. | Since no epimoric ratio can be divided into two equal ratios (because no number falls as a mean proportional in an epimoric interval, as we showed

⁶⁰² If Porphyry is right about what these people said, perhaps what they meant is that when these ratios are constructed on the monochord the resulting pairs of sounds are indeed heard as concords, but that their concordance is nevertheless not a consequence of their ratios; or, more radically, that no interval's musical identity depends on the ratio corresponding to it. They may have been relying on the fact that intervals whose ratios differ slightly from the 'correct' one for e.g. the perfect fifth are still perceived as perfect fifths – and hence, by Aristoxenian criteria, must *be* perfect fifths. Aristoxenus himself concedes that the size of each concord may vary, though only 'by a hair's breadth' (*El. harm.* 55.3–6). Hence though the intervals specified by the Pythagorean ratios are indeed concords, the concords as such are not 'in ratios'.

⁶⁰³ This paragraph paraphrases Ptol. *Harm.* 23.19–24.8, with a number of additions by Porphyry himself. The passage of Ptolemy runs as follows: 'One should not suppose that this sort of conflict is between reason and perception, but that it is the fault of those who adopt inconsistent premises, the more recent of them having employed a combination based on both criteria. For perception virtually shrieks its clear and unmistakable recognition of the concord of a fifth, when in the procedure on the monochord that has been set out it is constructed according to the hemiolic ratio, and that of the fourth, when it is constructed according to the epitritric. But they do not hold to its agreements, from which it follows absolutely that the difference between the concords, which is a tone, is in epogdoic ratio, and that the concord of a fourth is constituted from less than two and a half tones; but in the cases where perception is naturally competent to judge, that is, in respect of the greater differences, they are altogether distrustful of it, while in those where it is not by itself sufficient, that is, in cases where the differences are smaller, they trust it, or rather they bring to bear additional judgements opposed to those that are primary and more authoritative.' The 'additional judgements' might conceivably be those I suggest in the previous note.

- ον ὃ τ' ἐπὶ ις' καὶ ὃ ἐπὶ ιζ'· ἔσται ἄρα κατὰ τὸν μεταξύ πως τούτων λόγων εὐρεῖν τὸ ἡμιτόνιον, τουτέστι τὸν μείζονα μὲν τοῦ ἐπιεπτακαιδεκάτου, (20) ἐλάσσονα δὲ τοῦ ἐπιεκκαιδεκάτου· ἔστι δ' οὗτος ἔγγιστα ὁ σνη' <πρὸς σμγ'>.

- Ὡς μὲν γάρ ὁ ις' πρὸς τὸν ις', οὕτως ὁ σνη' καὶ <ἐξηκοστὰ> ια' πρὸς σμγ'. ὥς δ' ὁ ιη' πρὸς ιζ', οὕτω καὶ ὁ σνζ' καὶ <ἐξηκοστὰ> ιη' πρὸς τὸν σμγ'. καὶ ὁ μεταξύ ἄρα τῶν δύο λόγων ἐστὶν ὁ τῶν σνη' πρὸς τὰ (25) σμγ'.

- Διόπερ τὰ ιε' τῶν σμγ' μείζον μὲν ὄντα μέρος ἢ ἐπτακαιδέκατον, ἔλασσον δ' ἢ ἐκκαιδέκατον, προσθεῖς τοῖς σμγ' ἔσχεν λόγον τοῦ ἡμι-τονίου σύνεγγυς τὸν τῶν σνη' πρὸς τὰ σμγ'. ἔδειξε δὲ καὶ τὸν τοῦ λείμ-ματος λόγον τῶν σνς' πρὸς τὰ σμγ'· καὶ τοῦ λείμματος ἄρα τὸ ἡμιτό- (30) νιον μείζον ἐστὶ τῷ λόγῳ τῶν σνη' πρὸς τὰ σνς', οἱ εἰσιν ἐπὶ ρκη'. τὴν δὲ βραχεῖαν οὕτω διαφορὰν φησι δυνατὸν εἶναι κρίναι ταῖς ἀκοαῖς, οὐδ' αὐτοὶ φήσαιεν· εἴτα τούτοις ἐπάγει λέγων· εἰ τοῖνυν ἐνδέχεται τὸ ρκη' τὴν αἰσθησιν παρακοῦσαι, πολὺ μᾶλλον ἐνδεχόμενον ἦν διὰ πλειόνων λήψωεν τὸ μόριον τοῦτο συναχθὲν ἀνεπαίσθητον αὐτῇ γενέσθαι κατὰ τὴν

- (132) προειρημένην δεῖξιν, τρίς μὲν τοῦ διὰ τεσσάρων ληφθέντος, δις δὲ τοῦ διτόνου κατὰ διαφόρους θέσεις, ὁπότε μῆδ' ἅπαξ ποιήσαι δίτονον ἀκρι-βῶς πρόχειρόν ἐστι ταῖς αἰσθήσεσι. μᾶλλον γὰρ ἂν ποιήσειαν τόνον ἢ δίτονον, ἐπειδήπερ ὁ μὲν τόνος ἐμμελής τ' ἐστὶ καὶ ἐν ἐπογδόῳ λόγῳ, (5) τὸ δ' ἀσύνθετον δίτονον ἐκμελές, ὡσάν ἐν λόγῳ τῷ τῶν πα' πρὸς τὰ ξδ', ὅτι οὐχ ἄπλοῦν μέρος ἔχει, ἀλλὰ ἐξηκοστοτετάρτων <ιζ'>.

ια'

[25] Ἐναργέστερον δ' ἂν ἄρα ἀπελέγχοιτο τὸ προκείμενον μετὰ τῆς πρὸς τὰ τηλικαῦτα τῶν ἀκοῶν ἀδυναμίας ἀπὸ τῆς διὰ πασῶν ὁμωφωνίας.

18 κατὰ τὸν Alexanderson καὶ τὸ codd. 20-1 <πρὸς σμγ'> add. Wallis 22-3 <ἐξηκοστὰ> bis add. Düring, lacuna in textu codd. ἐξηκοντάδες Wallis ιςγ' νη' in marg V¹⁸⁷ 26 μείζον Alexan- derson μείζονα codd. 27 ἔσχεν Alexanderson ἔσχον codd.

6 ἐξηκοστοτετάρτων <ιζ'> scripsi ἐξηκοστοτετάρτων codd. τέλος τοῦ ι' κεφαλαίου add. p 7 ἀρχὴ τοῦ ια' κεφαλαίου add. p

above⁶⁰⁴), the most nearly equal ratios that make the epogdoic are 17:16 and 18:17. Then it will be possible to find the half-tone in a ratio that lies somehow between them, that is, one that is greater than 18:17 | but smaller than 17:16; and this is very close to 258:243.⁶⁰⁵ For as 17 is to 16, so is $258\frac{11}{60}$ to 243; and as 18 is to 17, so is $257\frac{18}{60}$ to 243. Thus the ratio between the two is that of | 258:243.⁶⁰⁶

Since 15 is a greater part than a seventeenth of 243 and less than a sixteenth part, when Ptolemy added it to 243 he found that the ratio of the half-tone is close to 258:243. He showed also that the ratio of the *leimma* is 256:243, and hence the half-tone is greater than the *leimma* | in the ratio of 258:256, which is 129:128; and he says that not even they would assert that so slight a variation can be judged by the hearing. He then pursues these points by saying that if it is possible for perception to mis-hear the one hundred-and-twenty-eighth part, it is much more possible for this part to be undetected by it when several instances of it are accumulated, as they are in the demonstration previously discussed, where the fourth is taken three times and the ditone twice, in different positions – when it is not easy for perception to construct a ditone accurately even once. For they could more readily construct a tone than a ditone, given that the tone is melodic and in epogdoic ratio, | whereas the incomposite ditone is unmelodic, being as it is in the ratio 81:64, since it does not involve a single part but seventeen sixty-fourths.⁶⁰⁷

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Chapter 11

Their proposition⁶⁰⁸ can be more clearly refuted, and the incapacity of the hearing in relation to things of this size more clearly shown, from

⁶⁰⁴ [Eucl.] *Sect. can.* prop. 3; cf. 99.15–26 above.

⁶⁰⁵ Down to this point, the paragraph paraphrases Ptol. *Harm.* 24.8–17, adding the brief statement in parentheses, and postponing a clause at *Harm.* 24.14–16 until 131.26 below.

⁶⁰⁶ These two sentences correspond to nothing in Ptolemy's text. The numbers that include sixtieths are hexagesimal approximations to the exact values, used by Ptolemy himself in some passages of the *Harmonics* (notably the tables set out in II.14–15) as well as in the *Almagest*.

⁶⁰⁷ The paragraph is a close paraphrase of Ptol. *Harm.* 24.14–29; the only substantial change is in the last clause (from 'since it does not'), where Ptolemy has 'and for perception the more commensurate intervals are the more easily grasped'. The gist of Porphyry's statement is the same, since an interval is 'commensurate', in Ptolemy's sense, if the difference between its terms is a 'simple part' (e.g. one third or one fifth) of the smaller term. It will then be a simple part also of the greater, and will therefore constitute a 'measure' of both. The sense of Porphyry's closing words, 'but seventeen sixty-fourths', is that in this ratio the difference between the terms amounts to that fraction of the smaller term, and is not a 'simple part' of either term.

⁶⁰⁸ Here and at the beginning of the next chapter the abbreviated form of the lemma (printed by Düring) quotes the first few words of the passage and then merely adds 'and so on', instead of quoting the words with which the relevant passage ends, as previous lemmata have done. But in the present chapter it evidently ends at 26.14, and Porphyry's close paraphrase of the next passage in Ptolemy (beginning at 133.28) takes the place of a second lemma.

ἀποφαίνονται μὲν γὰρ αὐτὴν ἐξ τόνων ἀκολουθῶς τῷ τὴν διὰ τεσσάρων συμφωνίαν δύο καὶ ἡμίσεος εἶναι τόνων, ὅτι τὸ διὰ πασῶν δις ἔχει τὸ διὰ τεσσάρων καὶ ἔτι τόνον. ἐὰν δὲ ἐπιτάξωμεν τῷ μουσικωτάτῳ ποι- [5] ῆσαι τόνους ἐφεξῆς καὶ καθ' αὐτούς ἐξ, μὴ συνεπιβαλλομένων μέντοι τῶν προηρμοσμένων φθόγγων, ἵνα μὴ καταφέρηται πρὸς ἄλλο τι τῶν συμφώνων, ὁ πρῶτος φθόγγος πρὸς τὸν ἑβδομον οὐ ποιήσῃ τὸ διὰ πασῶν. εἴτε δὲ μὴ παρὰ τὴν ἀσθένηειαν τῆς αἰσθήσεως συμβαίνει τὸ τοιοῦτο, ψευδὸς ἂν ἀποφαίνοι τὸ τὴν διὰ πασῶν συμφωνίαν ἐξ εἶναι τόνων, εἴτε [10] τῷ μὴ δύνασθαι λαμβάνειν αὐτὴν τοὺς τόνους ἀκριβῶς, πολὺ πλέον οὐκ ἔσται πιστὴ πρὸς τὴν τῶν διτόνων λῆψιν, ἀφ' ὧν εὐρίσκειν οἶεται τὸ διὰ τεσσάρων δύο καὶ ἡμίσεος τόνων. τοῦτο δὲ ἐστὶν ἀληθέστερον· οὐ γὰρ μόνον οὐ γίνεται τὸ διὰ πασῶν, ἀλλ' οὐδ' ἄλλο τι διὰ ταυτό μέγεθος πάντως τῆς διαφορᾶς, οὔτε ἐπὶ πάντων ἀρμοζόμενον οὐτ' ἐπὶ τῶν [15] αὐτῶν αἰ. καίτοι λαμβανόντων ἡμῶν κατὰ τὸν αὐτὸν τρόπον ἐφεξῆς τὸ τε διὰ τεσσάρων καὶ τὸ διὰ πέντε, ποιήσουσιν οἱ ἄκροι τὸ διὰ πασῶν, ὅτι ταῦτα ταῖς ἀκοαῖς ἐστὶν εὐοριστότερα. τῷ λόγῳ μέντοι ληφθέντων ἐξ τόνων ἐφεξῆς μεῖζόν τε βραχεῖ τοῦ διὰ πασῶν οἱ ἄκροι φθόγγοι ποιήσουσι μέγεθος, καὶ κατὰ τὴν αὐτὴν ὑπεροχὴν πάντοτε, τουτέστι τὴν [20] [26] διπλασίαν τῆς τοῦ λείμματος πρὸς τὸ ἡμιτόνιον, ἥτις ἔγγιστα συναγεται ἐν ἐπὶ ξδ' λόγῳ ταῖς πρώταις τῶν ὑποθέσεων ἀκολουθῶς.

Ἔσται δ' ἡμῖν καὶ τὸ τοιοῦτον εὐκατανόητον συνάψασιν ἐπτὰ χορδὰς ἄλλας ἐν τῷ κανόνι τῇ μιᾷ κατὰ τὴν ὁμοίαν ἀνάκρισιν τε καὶ θέσιν. ἐὰν γὰρ ἰσοτόνους ἀρμοσώμεθα τοὺς ὀκτῶ φθόγγους ἐν ἴσοις ταῖς [5] τῶν χορδῶν μήκεσιν ἀκριβῶς ὥστε τοὺς ΑΒΓΔΕΖΗΘ, ἔπειτα διὰ τῆς τοῦ κανονίου προσαγωγῆς εἰς ἐξ τοὺς ἐφεξῆς ἐπογδόους λόγους διαιρεθέντος παραφέρωμεν καθ' ἕκαστον φθόγγον τὸ παραπλήσιον ὑπαγώγιον ἐπὶ τὴν οἰκείαν τομὴν, ἵνα ὡς ἐπόγδοος ἦ ἡ τε ΑΚ διάστασις τῆς ΒΛ καὶ αὕτη τῆς ΓΜ καὶ αὕτη τῆς ΔΝ καὶ αὕτη τῆς ΕΞ καὶ αὕτη [10] τῆς ΖΟ καὶ αὕτη τῆς ΗΠ, ποιεῖ δὲ καὶ ἡ ΑΚ πρὸς τὴν ΘΡ τὸν διπλασίον λόγον, οὗτοι μὲν ὁμοφωνήσουσιν ἀκριβῶς οἱ φθόγγοι κατὰ τὸ διὰ πασῶν, ὁ δὲ ΠΗ τοῦ ΘΡ βραχεῖ καὶ τῷ αὐτῷ πάντοτε ἔσται ὀξύτερος.

- (9) Ἔτι μᾶλλον φανερώτερον ἐλέγξαι βουλόμενος τὸ τὴν διὰ τεσσάρων
 (10) συμφωνίαν μὴ εἶναι δύο ἡμίσεος τόνων ἀπὸ τῆς διὰ πασῶν συμφωνίας, ἦν αὐτὸς ὁμοφωνίαν ἐκάλεσεν, τοῦτο δεῖξαι πειράται. αὐτοὶ μὲν οὖν τὴν διὰ πασῶν ἀποφαίνονται τόνων ἐξ, ὅτι δις ἔχει τὸ διὰ τεσσάρων ὡς δύο <καὶ> ἡμίσεος τόνων καὶ ἔτι τόνον. ἐὰν γὰρ ἐπιτάξωμεν, ὡς φησι, τῷ μουσικωτάτῳ τόνους ἐφεξῆς καὶ καθ' ἑαυτοὺς ἐξ ποιῆσαι—μὴ

consideration of the homophone of the octave. For they claim that it consists of six tones, in accordance with the thesis that the concord of a fourth consists of two and a half tones, since the octave contains the fourth twice and a tone in addition. If we instruct the most expert musician to construct six tones in succession, just by themselves, and without the aid of other notes tuned beforehand, so that he cannot refer to any other of the concords, the first note will not make an octave with the seventh. Now if this sort of result is not due to the weakness of perception, the claim that the concord of the octave consists of six tones would be shown to be false; but if it is because perception cannot construct the tones accurately, it will be much less reliable in the construction of ditones, from which he supposes that he can discover that the fourth consists of two and a half tones. But the following is nearer the truth: not only does the octave not arise, but neither does anything else arise through <additions of> the same magnitude of difference throughout, whether it is tuned on all <the strings?> or always on the same ones.⁶⁰⁹ Yet if in the same way we take in succession the fourth and the fifth, since these are more easily determined by ear, the extremes will form the octave.

If however we construct six tones in succession by reason [or 'ratio', *logos*], the extreme notes will make a magnitude slightly greater than an octave; and it will always be by the same degree of difference, that is, double the difference between the *leimma* and the half-tone, which, in accordance with the first of our postulates, comes very close to being in the ratio 65:64.

This sort of result will be easily grasped if we fasten seven more strings on the *kanōn*, in association with the one string, on the basis of the same kind of selection and placing. For if we accurately attune the eight notes at equal pitch in equal lengths of the strings, the notes ABCDEZHF, and if then, by application of the measuring-rod divided into six epogdoic ratios in succession, we place an identical bridge at the proper division corresponding to each note, to make distance AK the epogdoic of BL, BL that of CM, CM that of DN, DN that of EX, EX that of ZO, ZO that of HP, while AK makes with FR the double ratio, the latter notes will sound accurately the homophone of the octave, but PH will be slightly higher than FR, and always by the same amount. Ptol. *Harm.* 25.1–26.14

Since Ptolemy wants to prove even more clearly that the concord of a fourth | is not two and a half tones, he sets off to show this by starting from the concord of an octave, which he calls a homophone. Now they [the Aristoxenians] assert that the octave consists of six tones, since it contains the fourth – conceived as two and a half tones – twice, and a tone in addition. For if we instruct the most expert musician, he says, to construct six tones in succession, just by themselves, and without | the aid

⁶⁰⁹ See Porph. 132.29–133.2 with n. 610 below.

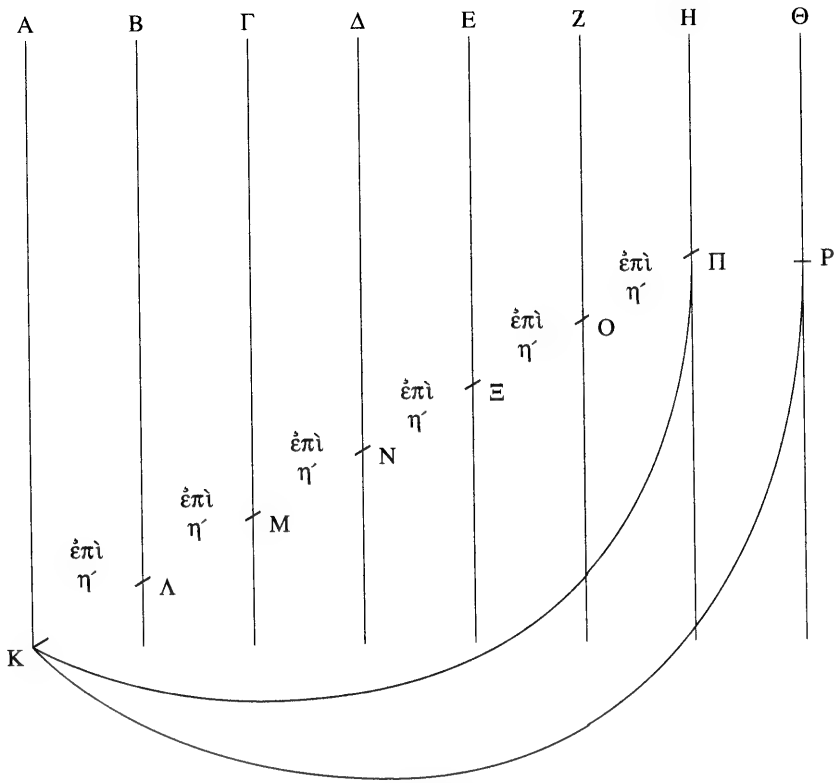


Figure 4G

- (15) συνεπιβαλομένων μέντοι τῶν προηρμοσμένων φθόγγων, ἵνα μὴ κατα-
φέρηται πρὸς ἄλλο τι τῶν συμφώνων ὁ μουσικός, ἀλλὰ μόνον τὸν τόνον
ἐξετάζει, μὴ τῷ πρώτῳ φθόγγῳ φέρε δια πασῶν ἐπιτείνας τὴν μέσσην,
ταύτη δὲ διὰ τεσσάρων ἐπὶ τὸ βαρὺ τὴν ὑπάτην μέσων καὶ ταύτη διὰ
τεσσάρων τὴν ὑπάτην ὑπάτων λάβη τὸν δεύτερον φθόγγον ἀπέχοντα τοῦ
(20) πρώτου φθόγγου τόνον—ὁ πρώτος φθόγγος πρὸς τὸν ἑβδομον οὐ ποι-
ήσῃ τὸ διὰ πασῶν σύμφωνον, ὡς δειχθήσεται. εἴ τ' αὖν μὴ παρὰ τὴν
ἀσθένειαν τῆς αἰσθήσεως συμβαίνει τὸν πρώτον φθόγγον πρὸς τὸν ἑβδο-
μον μὴ ποιεῖν τὸ διὰ πασῶν, ψεῦδος ἂν εἴποι ὁ μουσικός τὸ τὴν διὰ
πασῶν συμφωνίαν ἔξ τόνων εἶναι, εἴ τε τῷ μὴ δύνασθαι λαμβάνειν τὴν
(25) αἴσθησιν τοὺς τόνους ἀκριβῶς, πολὺ πλέον οὐκ ἀξιопιστότερος ἔσται πρὸς

15 συνεπιλαμβανομένων GV¹⁸⁷

24 τῷ] τό p

25 οὐκ p om. ceteri

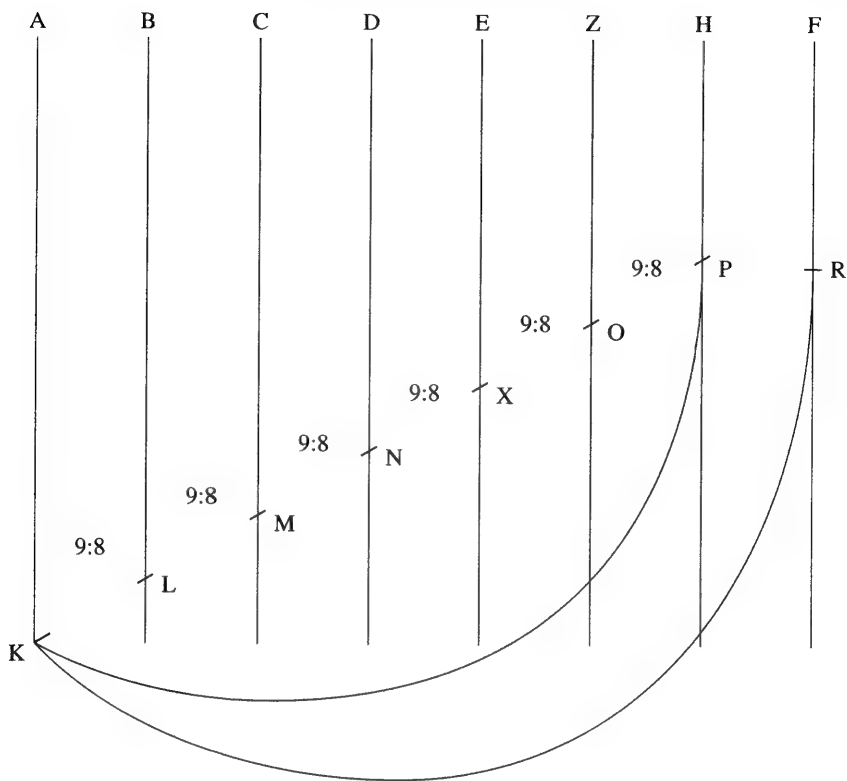


Figure 4

of other notes attuned beforehand, so that he cannot refer to any other of the concords but assesses only the tone (not, for instance, pitching *mesē* an octave above the first note, *hypatē mesōn* a fourth below *mesē* and *hypatē hypatōn* a fourth below that, so that in this way he constructs the second note | at the interval of a tone from the first), the first note will not make the concord of an octave with the seventh, as will be shown. Now if it is not due to the weakness of perception that the first note does not make an octave with the seventh, the musical expert [Aristoxenus] must be wrong in saying that the concord of an octave consists of six tones; and if it is because perception cannot | construct the tones accurately, it will be much less trustworthy in the construction of ditones, from which he supposes that he can discover that the fourth consists of two and a half tones. But the following is nearer the truth, that it will not be reliable in the

τὴν τῶν διτόνων λῆψιν, ἀφ' ὧν εὐρίσκειν ὑπολαμβάνεται τὸ διὰ τεσσάρων δύο καὶ ἡμίσεος τόνων. τοῦτο δ' ἐστὶν ἀληθέστερον, ὅτι πρὸς τὴν τῶν διτόνων λῆψιν οὐκ ἔσται πιστή. οὐ γὰρ μόνον οὐ γίνεται τὸ διὰ πασῶν, ἀλλ' οὐδ' ἄλλο τι διὰ ταῦτο μέγεθος πάντως τῆς διαφορᾶς, οὗτ' ἐπὶ

- (133) πάντων [τῶν] ἀρμοζόμενον, πρόσω τε καὶ ὀπίσω, οὗτ' ἐπὶ τῶν αὐτῶν ἀεί. κατὰ τόνον γὰρ καὶ τόνον καὶ ἡμιτόνιον οὐ λαμβάνεται <ῆ> ἢ διὰ τεσσάρων συμφωνία ἢ ἄλλη τις τῶν προειρημένων. λαμβανόντων δ' ἡμῶν κατὰ τὸν αὐτὸν τρόπον τῆς αἰσθήσεως ἐφεξῆς τὸ τε διὰ τεσσάρων
- (5) καὶ τὸ διὰ πέντε, ποιήσουσιν οἱ ἄκροι τὸ διὰ πασῶν, ὅτι ταῦτα ταῖς ἀκοαῖς ἐστὶν εὐοριστότερα. τῷ λόγῳ μέντοι ληφθέντων ἕξ τόνων ἐφεξῆς ἐν ὀκταχόρδῳ κανόνι μεῖζόν τε βραχεῖ τοῦ διὰ πασῶν οἱ ἄκροι φθόγγοι ποιήσουσι μέγεθος καὶ κατὰ τὴν αὐτὴν ὑπεροχὴν πάντοτε, τουτέστι τὴν διπλασίαν τῆς τοῦ λείμματος πρὸς τὸ ἡμιτόνιον, ἣτις ἔγγιστα συνάγεται
- (10) ἐν ἐπὶ ξδ' λόγῳ ταῖς πρώταις τῶν ὑποθέσεων ἀκολουθῶς. δύο γὰρ λείμματα συνάγεται, ἐν μὲν τοῦ διὰ τεσσάρων, ἕτερον δὲ τοῦ διὰ πέντε, καὶ τὰ δύο <ἐπὶ> ρκη' ἓνα <ἐπὶ> ξδ' λόγον ποιεῖ. γίνεται δὲ τὸ τοιοῦτο εὐκατανόητον τῷ βουλομένῳ συνάψαντι χορδὰς ἄλλας ἐπτὰ τὸν ἀριθμὸν πρὸς τῇ προειρημένῃ μιᾷ ἐπὶ τοῦ μονοχόρδου κανόνος ὁμοίαν ἀνάκρισιν διὰ τῶν
- (15) μαγάδων καὶ θέσιν παράλληλον αὐτῇ λαμβανούσας.

Ἐὰν γὰρ τις ἰσοτόνους ἀπλῶς ἀρμόσῃται τοὺς ὀκτώ φθόγγους ἐν ἴσοις τοῖς τῶν χορδῶν μήκεσι μόνον ἀκριβῶς, οὐ πάντως δὲ κἀν τοῖς πάχεσιν αὐτῶν ἢ τῇ ὁμοίᾳ πυκνότητι, ὥς τοὺς ΑΒΓΔΕΖΗΘ· ἔπειτα διὰ τῆς τοῦ ξυλίνου κανονίου προσαγωγῆς εἰς ἕξ τοὺς ἐφεξῆς ἐπογδόους

29 ταυτό scripsi τό codd. cfr. Ptol. 25.14

1 [τῶν] deleui ἀρμοζόμενον scripsi cfr. Ptol. 25.15 ἀρμοζομένων codd. 2 <ῆ> add. Düring
12 τὰ δύο <ἐπὶ> ρκη' ἓνα <ἐπὶ> ξδ' λόγον scripsi τὰ δύο ρκη' ἓνα ξδ' λόγον Düring τὰ δύο ρκη' ἐν ἐξηκοστοτετάρτῳ λόγῳ codd. τὰ δύο ρκη' ἐν ἐξηκοστοτετάρτον λόγῳ vel τὰ δύο ρκη' ἐπὶ ξδ' λόγον
Alexanderson 17–18 τοῖς πάχεσιν p

construction of ditones. For not only does the octave not arise, but neither does anything else arise through <additions of> the same magnitude of difference throughout, either on the basis of all the things that are attuned forwards and backwards, or on the basis of the same ones every time.⁶¹⁰ [133D] For neither the concord of a fourth nor any of the others that have been mentioned is constructed through tone, tone and half-tone. But when we construct the fourth and the fifth in succession, using perception | in the same way, the extreme notes make the octave, since these things are more readily identified by the hearing. On the other hand, when six tones are constructed by reason [or 'ratio', *logos*] on the eight-stringed *kanōn*, the extreme notes make a magnitude slightly greater than the octave, greater always by the same amount, that is, by twice the excess of the half-tone over the *leimma*, which, | in accordance with our first postulates, comes very close to being in the ratio 65:64. For two *leimmata* are put together, one belonging to the fourth and the other to the fifth, and the two instances of the ratio 129:128 make a single ratio of 65:64.⁶¹¹ This sort of result will be easily grasped by someone willing to fasten more strings, seven in number, in addition to the one already mentioned on the single-stringed *kanōn*, these being tested in the same way by means of the | bridges,⁶¹² and positioned parallel to the first.

For if one tunes the eight notes ABCDEZHF accurately to precisely equal pitches in equal lengths of the strings (which, however, are not necessarily equal also in their thicknesses, or of the same density), and if then, by application of the wooden measuring-rod (*kanonion*) divided into

⁶¹⁰ This is the best I can make of a very difficult sentence. The text of the corresponding passage in Ptolemy varies between the MSS. None of the variants is easy to understand, and neither is the version adopted by Düring; and I am not sure that the text of Porphyry, even with my minor emendation, can be construed as an accurate paraphrase of any of them. (I have adopted 'the same magnitude' from the principal Ptolemy MSS, where the Porphyry MSS have simply 'the magnitude'.) The scholiasts interpret 'all the things that are attuned' as a reference to instruments of all kinds, and 'the same ones' as a reference to a single string on a single kind of instrument; if they are right a simple 'on' should replace 'on the basis of' in the translation. But if their view were correct we would certainly expect 'the same one' rather than 'the same ones' in the last phrase; and in any case the number of instruments or strings involved seems irrelevant in this context. I suggest instead that 'all the things that are attuned forwards and backwards' refers to all the intervals (specifically the successive fifths and fourths) that are attuned 'forwards and backwards' – i.e. upwards and downwards – in the Aristoxenians' method of constructing a tone or a ditone, and that 'the same ones every time' refers to the construction of a sequence of identical intervals (specifically the construction of six successive tones in an attempt to reach the octave), without the help of moves through intervals of any other sizes. (No version of Ptolemy's text includes the phrase 'forwards and backwards'.) My thanks to Massimo Raffa for discussing the problems with me in detail, but we differ on certain points and he should not be held responsible for my interpretation.

⁶¹¹ This approximation has presumably been reached by treating $(130:129) \times (129:128)$, which is $130:128 = 65:64$, as close enough for present purposes to the true figure, $129^2:128^2$.

⁶¹² For the procedure see 122.8–26 above.

- (20) λόγους διηρημένου λαβών σημεία καθ' ἕκαστον φθόγγον, ὡς τὰ ΚΛΜΝ ΞΟΠΡ, παραφέρῃ παραπλήσιον ὑπαγωγίδιον ἐπὶ τὴν οἰκείαν τομὴν, τουτέστι τὸ ληφθὲν σημεῖον, ἵνα ἐπόγδοος ἦ, ἡ μὲν ΑΚ διάστας τῆς ΒΛ, ἡ δὲ ΒΛ τῆς ΓΜ, ἡ δὲ ΓΜ τῆς ΔΝ, καὶ αὕτη τῆς ΕΞ, καὶ αὕτη τῆς ΖΟ, καὶ αὕτη τῆς ΗΠ, ποιεῖ δὲ καὶ ἡ ΑΚ πρὸς τὴν ΘΡ τὸν διπλάσιον λόγον, οὗτοι μὲν ἅμα πληχθέντες οἱ φθόγγοι συμφωνήσουσιν ἀκριβῶς τὸ διὰ πασῶν ὁμόφωνον· ὁ δὲ ΠΗ τοῦ ΘΡ βραχεῖ καὶ τῷ ἴσῳ πάντοτε καὶ οὐ ποτε μείζονι ἢ ἐλάττονι ὀξύτερος ἔσται.
- (25) Ὅτι δ' ἀδιαφοροῦσιν αἱ χορδαὶ μιᾶς, ὅταν πλείους ὦσιν, ἐὰν ἐν ἴσοις μήκεσι ποιηθῶσιν ἰσότονοι, καὶ μὴ ὅμοιοι πάντως ὥσι τῇ τε παχύτητι καὶ τῇ πυκνότητι, δῆλον ἔσται ἐντεῦθεν. ἐπειδὴ γὰρ ἀπέδειξε, πῶς ἡ (30) περὶ τοὺς ψόφους ὀξύτης καὶ βαρύτης συνίσταται καὶ ὅτι τρία ἔστιν ἐπὶ τῶν χορδῶν τὰ αἴτια τῆς περὶ τὸ ὀξύ καὶ τὸ βαρὺ διαφορᾶς, ὧν τὸ μὲν ἐν τῇ πυκνότητι τῶν χορδῶν καὶ μανότητι θεωρεῖται, τὸ δ' ἐν τῇ περιοχῇ, τὸ δ' ἐν τῇ μείζονι καὶ ἐλάττονι διαστάσει· καὶ ὀξύτερος γίνεται
- (134) ὁ ψόφος ὑπὸ τῆς πυκνοτέρας ἢ τῆς μανοτέρας καὶ πάλιν ὑπὸ τῆς ἰσχυοτέρας μᾶλλον ἢ τῆς παχυτέρας καὶ ἔτι ὑπὸ τῆς κατὰ τὴν ἐλάττονα διάστασιν ἥπερ ὑπὸ τῆς κατὰ τὴν μείζονα ἀεί· παραλαμβάνεται δ' ὑπ' αὐτῶν ἀντὶ τῆς πυκνώσεως ἡ τάσις· τονοῖ γὰρ καὶ σκληρύνει καὶ διὰ τοῦτο (5) μᾶλλον ταῖς ἐν ταῖς ἐλάττοσι διαστάσεσι χορδαῖς ἡ ὁμοία τάσις· δῆλον, ὅτι τῶν ἄλλων ὑποκειμένων τῶν αὐτῶν, διαφορᾶς δ' οὐσης μιᾶς ὅτε μὲν παρὰ τὴν τάσιν τῶν χορδῶν, ἥτις ἀντὶ τῆς πυκνώσεως ἐλήφθη, ὅτε δὲ παρὰ τὴν περιοχὴν, ὅτε δὲ παρὰ τὴν διάστασιν, ὡς μὲν ἡ πλείων γίνεται τάσις πρὸς τὴν ἐλάττονα, οὕτως ὁ κατὰ τὴν πλείονα τάσιν ψόφος (10) πρὸς τὸν κατὰ τὴν ἐλάττονα· ὡς δ' ἡ μείζων περιοχὴ πρὸς τὴν ἐλάττονα περιοχὴν, οὕτως ὁ κατὰ τὴν ἐλάττονα περιοχὴν ψόφος πρὸς τὸν κατὰ τὴν μείζονα· ὡς δ' ἡ μείζων διάστας πρὸς τὴν ἐλάττονα, οὕτως ὁ κατὰ τὴν ἐλάττονα διάστας ψόφος πρὸς τὸν κατὰ τὴν μείζονα.
- Τούτων δ' οὕτως ὑποκειμένων λέγω, ὅτι τῶν ἀνομοίων χορδῶν, ὅταν (15) ἐν ἴσοις μήκεσιν ἰσότονοι ποιηθῶσι, ἀνταναπληροῦται τὸ παρὰ τὴν μείζονα περιοχὴν ἐνδέον τοῦ ψόφου τῷ παρὰ τὴν πλείονα τάσιν ὑπερβάλλοντι, καὶ γίνεται πάντως ὁ τῆς μείζονος περιοχῆς πρὸς τὴν ἐλάσσονα

27 μείζονι Wallis μείζον codd.

3 κατὰ] τατὰ typographico errore Düring

six successive epogdoic | ratios, one marks symbols corresponding to each note, KLMNXOPR, and if one next places a little bridge (*hypagōgēdion*) identical with each of the others at the appropriate division, that is, at the designated symbol, so that distance AK⁶¹³ is the epogdoic of BL, BL of CM, CM of DN, that one of EX, that one of ZO, and that one of HP, while AK is in double ratio with FR, | these latter notes will sound accurately in concord at the octave; but PH will be slightly higher in pitch than FR, always by the same amount and never by one that is greater or smaller.⁶¹⁴

That the strings do not differ from a single string when there are several of them, if they are made to be of equal pitch in equal lengths, even if they are not entirely similar in thickness | and density, will be clear from the following. Since Ptolemy has shown how height and depth of pitch in the notes are constituted, and that in strings there are three causes of difference in respect of high and low, of which one is found in the strings' greater or smaller density, one in their thicknesses and one in their greater or smaller length, and since the sound made by a denser, thinner or shorter string is always higher than one made by a string that is less dense or thicker or longer; and since, in strings, tension is substituted for density – for the same amount of tension tenses and stiffens and | does so more strongly in shorter strings – it is clear that if other factors are the same (so that there is just one difference, which is sometimes in the strings' tension – taken in place of density – sometimes in their thickness and sometimes in their length), then as the greater tension is to the smaller, so is the sound based on the greater | to that based on the smaller; and as the greater thickness is to the smaller, so is the sound based on the smaller to that based on the greater; and as the greater length is to the smaller, so is the sound based on the smaller to that based on the greater.

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Since these things are so, I say that when dissimilar strings are made | equal-toned in equal lengths, what is lacking on account of the greater thickness is made up for by what is in excess on account of the greater tension, and that the ratio of the greater thickness to the smaller is always

⁶¹³ 'Distance AK' is not the distance from A to K, which are identically placed on the string and the measuring-rod respectively; it is the distance from A (or, equivalently, from K), where the small movable bridge is placed, to the point of origin at the fixed bridge. The same applies to BL, CM and the rest. With Porphyry's additions to Ptolemy's account in this paragraph cf. his treatment of the monochord in I.8 above.

⁶¹⁴ The text concerned with opening lemma ends here (cf. n. 608 above). The rest of Porphyry's chapter quotes or closely paraphrases the remainder of Ptolemy's chapter, with only a few very minor alterations and additions (see n. 616 below).

λόγος ὁ αὐτὸς τῷ τῆς πλείονος τάσεως πρὸς τὴν ἐλάττονα. τοῦτο γὰρ αὐτὸς ἀπέδειξε διὰ γραμμῶν οὕτως.

- (20) Ἔστωσαν ἐν ἴσοις μήκεσιν ἰσότονοι δύο φθόγγοι, τουτέστιν ἀπαράλλακτοι κατὰ τὸν ψόφον, οἱ Α καὶ Β, καὶ μείζων ἢ τε περιοχὴ τοῦ Α τῆς τοῦ Β περιοχῆς καὶ δηλονότι καὶ ἡ τάσις. καὶ εἰλήφθω ἄλλος φθόγγος ἐν ἴσῳ τῷ μήκει ὁ Γ, τὴν μὲν περιοχὴν ἴσην ἔχων τῷ Β, τὴν δὲ τάσιν ἴσην τῷ Α. ἐπεὶ τοίνυν ὁ Γ τοῦ Β μόνῃ τῇ τάσει διαφέρει, ἔσται διὰ
- (25) τὰ ὑποκείμενα ὡς ἡ τοῦ Γ τάσις πρὸς τὴν τοῦ Β, οὕτως ὁ τοῦ Γ ψόφος πρὸς τὸν τοῦ Β ψόφον. πάλιν ἐπεὶ ὁ Γ τοῦ Α τῇ περιοχῇ μόνῃ διαφέρει, ἔσται ὡς ἡ τοῦ Α περιοχὴ πρὸς τὴν τοῦ Γ περιοχὴν, οὕτως ὁ τοῦ Γ ψόφος πρὸς τὸν τοῦ Α ψόφον. ἀλλ' ὡς ὁ τοῦ Γ ψόφος πρὸς τὸν τοῦ Α, οὕτως ὁ τοῦ Γ ψόφος πρὸς τὸν τοῦ Β· ἴσοι γὰρ οἱ ψόφοι τῶν Α καὶ
- (30) τῶν Β· ὡς ἄρα ἡ τοῦ Γ τάσις πρὸς τὴν τοῦ Β, οὕτως ἡ τοῦ Α περιοχὴ πρὸς τὴν τοῦ Γ. καὶ ἔστιν ὡς μὲν ἡ τοῦ Γ τάσις πρὸς τὴν τοῦ Β, οὕτω καὶ ἡ τοῦ Α τάσις πρὸς τὴν τοῦ Β· ἴσαι γὰρ αἱ τῶν Α καὶ Γ τάσεις. ὡς δ' ἡ τοῦ Α περιοχὴ πρὸς τὴν τοῦ Γ, οὕτως ἡ τοῦ Α περιοχὴ πρὸς τὴν τοῦ Β· ἴσαι γὰρ αἱ τῶν Β καὶ Γ περιοχαί. καὶ ὡς ἄρα ἡ τοῦ Α τάσις
- (35) πρὸς τὴν τοῦ Β τάσιν, οὕτως ἡ τοῦ Α περιοχὴ πρὸς τὴν τοῦ Β περιοχὴν. Τοῦτο δ' ἂν αὐτοῖς συνέβαινε, καὶ εἰ παντάπασιν ἦσαν ἀπαράλλακτοι
- (135) καὶ ἀδιαφοροῦντες ἐνός. πάλιν δ' ἂν ἐπὶ τῶν οὕτως ἐχόντων τὰς περιοχὰς καὶ τὰς τάσεις ὁμοίας ἀνίσους δὲ τὰς διαστάσεις ποιῶμεθα <πρὸς> τὴν δεῖξιν, οἷον τοῦ ΑΒ καὶ τοῦ ΓΔ ἴσων μειοῦντες τὸν ΓΔ ὡς μέχρι τῆς ΓΕ, ἔσται ὡς ἡ ΑΒ διάστασις πρὸς τὴν ΓΕ διάστασιν, οὕτως ὁ τῆς ΓΕ
- (5) ψόφος πρὸς τὸν τῆς ΑΒ ψόφον. ἐπεὶ γὰρ ἔστιν ὡς ἡ ΓΔ διάστασις πρὸς τὴν ΓΕ διάστασιν, οὕτως ὁ τῆς ΓΕ ψόφος πρὸς τὸν τῆς ΓΔ ψόφον, ἴση δ' ἔστιν ἢ τε ΑΒ διάστασις τῇ τῆς ΓΔ καὶ ὁ τῆς ΑΒ ψόφος τῷ τῆς ΓΔ· γίνεται ἄρα καὶ ὡς ἡ ΑΒ διάστασις πρὸς τὴν ΓΕ διάστασιν, οὕτως ὁ τῆς

2 <πρὸς> add. Alexanderson

3 ἴσων Alexanderson ἴσων codd.

the same as that of the greater tension to the smaller. Ptolemy demonstrates this through diagrams, as follows.⁶¹⁵

| Let there be two notes, A and B, which are equal-toned (that is, identical in respect of their sound) in equal lengths, and let the thickness of A – and therefore its tension too, of course – be greater than that of B. Let another note, C, be taken in equal length, having a thickness equal to that of B and a tension equal to that of A. Since then C differs from B only in tension, and | because of the conditions specified, as the tension of C is to the tension of B, so will be the sound of C to the sound of B. Again, since C differs from A only in thickness, then as the thickness of A is to the thickness of C, so will be the sound of C to the sound of A. But as the sound of C is to that of A, so is the sound of C to that of B, since the sounds of A and B | are equal. Therefore as the tension of C is to that of B, so is the thickness of A to that of C; and as is the tension of C to that of B, so is the tension of A to that of B, since the tensions of A and C are equal; and as the thickness of A is to that of C, so is the thickness of A to that of B, since the thicknesses of B and C are equal. Hence as the tension of A is | to the tension of B, so is the thickness of A to the thickness of B.

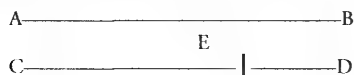
This would be true of them even if they were in all respects identical and differed in no way from a single string. But again, if in this situation we make the thicknesses and tensions alike but the lengths unequal for the purposes of the demonstration, for instance in the equal strings AB and CD, by diminishing CD to CE, then as the length AB is to the length CE, so will be the sound of CE | to the sound of AB. For since as the length CD is to the length CE, so is the sound of CE to the sound of CD, and since the length AB is equal to the length of CD and the sound of AB is equal to the sound of CD, then as the length AB is to the length CE, so is the sound

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⁶¹⁵ In the form presented in the Ptolemy MSS these diagrams amount to very little. The reasoning laid out in the next paragraph is illustrated with the diagram:

greater thickness	greater tension
A —————	
smaller thickness	smaller tension
B —————	
smaller thickness	greater tension
C —————	

The diagram illustrating the discussion set out in the paragraph after that is:



- (10) ΓΕ ψόφος πρὸς τὸν τῆς AB ψόφον. ἀντιπεπόνθασι γὰρ οἱ φθόγγοι τῶν χορδῶν τοῖς μήκεσιν.

ιβ'

Περὶ μὲν οὖν τῶν μείζονων ἐν τοῖς φθόγγοις διαφορῶν τοσαῦτα [15] ἡμῖν διωρίσθω. μετιτέον δὲ ἐπὶ τὰς ἐλάττους καὶ τὴν πρώτην καταμετρούσας τῶν συμφωνιῶν, αἵτινες λαμβάνονται τοῦ διὰ τεσσάρων εἰς τρεῖς λόγους διαιρουμένου κατὰ τὸν ἀκόλουθον τοῖς προδιωρισμένοις τρόπον, ἵνα τὸ μὲν πρῶτον ὁμόφωνον ἔν ὃν ἐκ δύο τῶν πρώτων συμφωνιῶν ἢ συντεθειμένον, τὸ δὲ πρῶτον σύμφωνον ἐκ τριῶν ἐμμελῶν μέχρι [20] τοῦ τὴν ἀναλογίαν περαίνοντος ἀριθμοῦ. τὴν δ' οὖν διαίρεσιν τοῦ διὰ τεσσάρων οὐ τὴν αὐτὴν εἶναι πανταχῇ συμβέβηκεν, ἄλλοτε δ' ἄλλως συνίστασθαι, τῶν μὲν ἄκρων δύο φθόγγων μενόντων, ἵνα τηρῶσι τὸ προκείμενον σύμφωνον, παρ' ἣν αἰτίαν καλοῦσιν αὐτοὺς ἐστῶτας, τῶν δὲ μεταξύ δύο κινουμένων, ἵνα ποιῶσιν ἀνίσους τὰς τῶν ἐν αὐτῷ φθόγ- [25] γων ὑπεροχάς. καλεῖται μὲν οὖν ἡ τοιαύτη κίνησις μεταβολὴ κατὰ γένος, καὶ γένος ἐν ἀρμονίᾳ ποιά σχέσις πρὸς ἀλλήλους τῶν συντιθέντων φθόγγων τὴν διὰ τεσσάρων συμφωνίαν. τοῦ δὲ γένους πρώτη μὲν ἐστὶν ὡς εἰς δύο διαφορά, κατὰ τὸ μαλακώτερον καὶ κατὰ τὸ συντονώτερον' [29] ἔστι δὲ μαλακώτερον μὲν τὸ συνακτικώτερον τοῦ ἤθους, συντονώτερον δὲ τὸ διαστατικώτερον' δευτέρα δὲ ὡς εἰς τρία, τοῦ μὲν τρίτου μεταξὺ πως τῶν εἰρημένων δύο τιθεμένου, καὶ τοῦτο μὲν καλεῖται χρωματικόν. τῶν δὲ λοιπῶν ἐναρμόνιον μὲν τὸ μαλακώτερον αὐτοῦ, διατονικόν δὲ τὸ συντονώτερον [5]

- (14) Λέγει μὲν οὖν μείζονας διαφορὰς τὰς κατ' ὀξύτητα καὶ βαρύτητα
 (15) προειρημένας ἐπὶ τῶν ἑξ συμφωνιῶν τοῦ τ' ἐπιτρίτου λόγου καὶ τοῦ ἡμιολίου καὶ τοῦ διπλασίου καὶ τῶν λοιπῶν. μετῆλθε δ' ἐπὶ τὰς ἐλάττους διαφορὰς τῶν ψόφων καὶ τὴν πρώτην τῶν συμφωνιῶν καταμετρούσας ἢ συμπληρούσας αὐτήν, αἵτινες λαμβάνονται τοῦ διὰ τεσσάρων συμφώνου, τούτέστι τοῦ ἐπιτρίτου λόγου εἰς τρεῖς λόγους διαιρουμένου κατὰ τὸν ἀκόλουθον τοῖς προδιωρισμένοις περὶ τῆς τάξεως τῶν συμφωνιῶν τρόπον, τοῦ μείζονος τῶν διαστημάτων πρὸς τῷ ὀξυτάτῳ φθόγγῳ τας-

10 τέλος τοῦ ια' κεφαλαίου add. p
 Alexanderson τὴν τῶν πρώτων codd.

11 ἀρχὴ τοῦ ιβ' κεφαλαίου add. p

17 τὴν πρώτην τῶν

of CE to the sound of AB. For the notes of the strings vary inversely| with their lengths.⁶¹⁶

Chapter 12

Let these points complete our account of the greater differences between the notes. We must now turn to the smaller ones that measure the first of the concords, which are found when the fourth is divided into three ratios in the way corresponding to what has already been determined, so that the first homophone, which is one, may be put together from the two first concords, and the first concord from three melodics, up to the number that bounds this proportion. Now the fact is that the division of the fourth is not the same in all cases, but is constituted differently on different occasions, the two extreme notes remaining stationary, to maintain the concord in question (for which reason people call them 'standing' notes), while the two in between move, to make the differences between the notes in it unequal. This sort of movement is called modulation in respect of genus, and a genus in *harmonia* is a specific kind of relation that the notes composing the concord of the fourth have to one another. The first distinction of genus is into two, corresponding to its being softer or more tense: the softer is that which is more inclined to draw the character together, the more tense that which is more inclined to divide it. The second distinction is into three, the third being placed somehow between the two mentioned, and this is called 'chromatic'. Of the others, the one softer than it is called 'enharmonic', and the tenser one 'diatonic'. Ptol. *Harm.* 28.15–29.5.⁶¹⁷

By 'the greater differences' he means those in respect of height and depth | that have been mentioned above in connection with the six concords and the epitritie ratio and the hemiolic and the double and the rest. He has turned now to the smaller differences between sounds, which measure or fill out the first of the concords, and which are found when the concord of a fourth – that is, the epitritie ratio – is divided into three ratios in the way corresponding to what has already been established about the arrangement of the concords, | with the larger of the intervals set next to the highest

⁶¹⁶ From 133.28 onwards, Porphyry has done little more than to quote the text of Ptol. *Harm.* 26.15–28.12. His main additions to the passage are these: 'even if . . . and density' at 133.29–30, 'than one made . . . thicker or longer' at 134.1–3, the parenthesis at 134.6–8, 'and as the greater length . . . based on the greater' at 134.12–13, the parenthesis at 134.20–1, and the final sentence of the chapter, 135.9–10. Part of the sentence at 135.1–5 is paraphrased rather than quoted from Ptol. *Harm.* 28.5–8, but the sense is not substantially affected.

⁶¹⁷ As in the previous chapter, the abbreviated form of the opening lemma does not specify where it ends. In fact it ends at *Harm.* 29.4; Porphyry moves on to the next stretch of the passage at 136.27, quoting *Harm.* 29.5–7, and embeds the rest of the text of Ptolemy's chapter, quoted or closely paraphrased, in the remainder of his own.

σομένου, ἵνα δῆλον, ὅτι τὸ μὲν πρῶτον ὁμόφωνον, ὅπερ ἐστὶ διὰ πασῶν, ἐν ὃν ἐκ δύο τῶν πρώτων συμφωνιῶν τοῦ τε διὰ πέντε καὶ τοῦ διὰ τεσσάρων ἢ συντεθειμένον, τὸ δὲ πρῶτον σύμφωνον ἐλάχιστον ὃν πάντων

(25) ἐκ τριῶν ἐμμελῶν διαστημάτων, τουτέστι μέχρι τοῦ ἐπιτρίτου λόγου.

Τὴν δ' οὖν διαίρεσιν τοῦ διὰ τεσσάρων οὐ τὴν αὐτὴν εἶναι πανταχῇ συμβέβηκεν <ἀλλ'> ἄλλοτ' ἄλλως συνίστασθαι· πρὸς γὰρ τὰ γένη καὶ διαιρέσεις τῶν τετραχόρδων γίνονται ἄλλως μὲν ἐν τῷ ἐναρμονίῳ, ἄλλως δ' ἐν τῷ χρωματικῷ καὶ ἄλλως ἐν τῷ διατονικῷ, γενικῆς οὔσης τῆς

(30) μεταβολῆς, ὡς προϊόντος τοῦ λόγου δειχθήσεται, τῶν μὲν ἄκρων δύο φθόγγων μενόντων, ἵνα τηρῶσι τὸ προκείμενον σύμφωνον ἐν ἐπιτρίτῳ

(136) λόγῳ, παρ' ἣν αἰτίαν καλοῦσιν αὐτοὺς ἐστῶτας, τῶν δὲ μεταξύ δύο κινουμένων, ἵνα ποιῶσιν ἀνίσους τὰς τῶν ἐντὸς φθόγγων ὑπεροχάς, καὶ δηλονότι τοὺς λόγους ἐν ταῖς τῶν γενῶν μεταβολαῖς, ὡς ἀπὸ χρώματος εἰς ἐναρμόνιον ἢ διατονικόν. καλεῖται μὲν οὖν φησιν ἡ τοιαύτη κίνησις

(5) μεταβολὴ κατὰ γένος· καὶ γένος ἐν ἀρμονίᾳ ποιαὶ σχέσις πρὸς ἀλλήλους τῶν συντιθέντων φθόγγων τὴν διὰ τεσσάρων συμφωνίαν.

Τοῦ δὲ γένους πρώτη μὲν ἐστὶν ὡς εἰς δύο διαφορά· κατὰ τὸ μαλακώτερον, ὃ καλοῦσιν ἐναρμόνιον, καὶ κατὰ τὸ συντονώτερον, ὃ καλοῦσι διατονικόν. ἔστι δὲ μαλακώτερον μὲν τὸ συντακτικώτερον τοῦ ἥθους,

(10) συντονώτερον δὲ τὸ διαστηματικώτερον. δευτέρα δ' ὡς εἰς τρία, τοῦ μὲν τρίτου μεταξύ πως τῶν εἰρημένων δύο τιθεμένου· καὶ τοῦτο μὲν καλεῖ-

27 <ἀλλ'> add. Theiler

10 διαστηματικώτερον] διαστατικώτερον fortasse legendum

note,⁶¹⁸ in order to make it clear that the first homophone, the octave, which is one, is put together from the first two concords, the fifth and the fourth, and that the first concord, which is the smallest of all, is put together | from three melodic intervals, ones jointly amounting, that is, to the epitritic ratio.

Now the fact is that the division of the fourth is not the same in all cases, but is constituted differently on different occasions. For in the genera the divisions of the tetrachords become different in the enharmonic, the chromatic and the diatonic, this modulation being modulation in respect of genus, | as will be shown as the discussion proceeds, with the two extreme notes remaining stationary, to maintain the concord in question in epitritic ratio (for which reason people call them 'standing notes'), while the two between them move, to make the excesses of the notes inside it⁶¹⁹ – and obviously the ratios too – unequal in the modulations of the genera, for instance from chromatic to enharmonic or diatonic. Hence he says that this sort of change is called | modulation in respect of genus, and in *harmonia* a genus is a specific kind of relation that the notes composing the concord of a fourth have to one another.

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The first distinction of genus is into two, corresponding to its being softer (which they call 'enharmonic') or more tense (which they call 'diatonic'); the softer is that which is more inclined to draw the character together, | the more tense that which is more inclined to space it out.⁶²⁰ The second distinction is into three, the third being placed somehow between the two

⁶¹⁸ Porphyry apparently treats Ptolemy's 'in a way corresponding to what has already been established' as an allusion to the order in which the intervals are arranged within the tetrachord, and specifically to the fact that in most of Ptolemy's divisions (the main exception being the 'tense diatonic') the highest of the three intervals is larger than either of the others. (In other theorists' work too, the tetrachord contains no interval larger than the highest, though the second highest may be the same size.) But this is a misunderstanding. Ptolemy is not concerned with that issue here, and it plays no part in the discussion until I.15. Porphyry's insertion of it into his paraphrase also makes nonsense of the sentence's line of thought, since it has no bearing on the purpose attributed to it in the immediate sequel. See also n. 624 below.

⁶¹⁹ I translate literally, to preserve the translation of *hyperochai* as 'excesses'. Porphyry is referring to the 'excess' of one note in the tetrachord over another, the quantitative relation between the difference between the terms assigned to the pitches and the smaller of the two terms. But the substance of his meaning would be adequately caught by the paraphrase 'the differences (or "intervals") between the notes inside it'.

⁶²⁰ In a 'softer' genus the higher movable note in the tetrachord (usually specified as *lichanos*) lies closer to the bottom than in a 'tenser' one; cf. the quotation from Aristoxenus at 138.10–29 below. The 'character' (*ēthos*) mentioned here is that of the music, as it is in Ptolemy, not that of a person affected by it. When it is 'drawn together' the effect is mournful, and when 'divided' or 'spaced out' it is manly and heroic (see Cleon. *Harm.* 206.3–18 Jan, cf. Arist. *Quint.* 30.12–15, 40.15–17). The adjective I translate as 'more inclined to space out' (*diastēmatikōteros*) is unusual in this context, and may be a mistake for the *diastatikōteros* ('more inclined to divide') found in Ptolemy and elsewhere; but in any case the sense is not significantly affected.

- ται χρωματικόν. τῶν δὲ λοιπῶν ἐναρμόνιον μὲν τὸ μαλακώτερον αὐτοῦ, διατονικὸν δὲ τὸ συντονώτερον, ὥστ' εἶναι τρία γένη, οἷς Ἀρχύτας ἐχρή-
 (15) σατο μόνοις. Πτολεμαῖος γὰρ τὸ μὲν ἐναρμόνιον ἐφύλαξεν ἰδίαν ἔχον
 καὶ τὸ διατονικὸν ὁμοίως τονιαῖον ὀνομάσας καὶ ποιήσας ἄλλα δύο
 μαλακώτερον αὐτοῦ καὶ συντονώτερον τοῖς ἐξῆς ἀποδειχθησομένοις λό-
 γοις ἀκολουθῶς, τὰ πάντα γένη ἕξ ὑπεστήσατο, ὧν τὸ μὲν ἐναρμόνιον
 (20) σύγκειται ἕκ τε τοῦ ἐπὶ δ' καὶ τοῦ ἐπὶ κγ' καὶ ἐπὶ με', τὸ δὲ μαλακὸν χρω-
 ματικὸν ἕκ τε τοῦ ἐπὶ ε' καὶ τοῦ ἐπὶ ιδ' καὶ ἐπὶ κζ', τὸ δὲ σύντονον χρω-
 ματικὸν ἕκ τε τοῦ ἐπὶ ζ' καὶ τοῦ ἐπὶ ια' καὶ τοῦ ἐπὶ κα', τὸ δὲ μαλακὸν
 διατονικὸν ἕκ τε τοῦ ἐπὶ ζ' λόγου καὶ τοῦ ἐπὶ θ' καὶ τοῦ ἐπὶ κ', τὸ δὲ
 μαλακὸν ἔντονον ἕκ τε τοῦ ἐπὶ η' καὶ τοῦ ἐπὶ ζ' καὶ τοῦ ἐπὶ κζ', τὸ δὲ
 (25) σύντονον διάτονον ἕκ τε τοῦ ἐπὶ θ' λόγου καὶ τοῦ ἐπὶ η' καὶ τοῦ ἐπὶ ιε'.
 τοῦ δὲ σαφοῦς ἔνεκα καὶ τοὺς ἀριθμοὺς ὑπέταξα τῶν ἕξ τετραχόρδων
 ἔχοντας οὕτως.

ἐναρμονιον	χρῶμα μαλακόν	χρῶμα σύντονον	διάτονον μαλακόν	έντονον μαλακόν	διάτονον σύντονον
ἐπὶ δ'	ἐπὶ ε'	ἐπὶ ζ'	ἐπὶ ζ'	ἐπὶ η'	ἐπὶ θ'
ἐπὶ κγ'	ἐπὶ ιδ'	ἐπὶ ια'	ἐπὶ θ'	ἐπὶ ζ'	ἐπὶ η'
ἐπὶ με'	ἐπὶ κζ'	ἐπὶ κα'	ἐπὶ κ'	ἐπὶ κζ'	ἐπὶ ιε'

- (27) Ἰδιον δ' ἐστὶ τοῦ μὲν ἐναρμονίου καὶ τοῦ χρωματικοῦ τὸ καλούμενον
 πυκνόν, ὅταν οἱ πρὸς τῷ βαρυτάτῳ δύο λόγοι τοῦ λοιποῦ ἐνὸς ἐλάττους
 γένωνται συναμφοτέροι, ὥς ἐπὶ τῆς προκειμένης τῶν ἀριθμῶν ἐκθέσεως,

mentioned, and this is called 'chromatic'. Of the others, the one softer than it is enharmonic, the tenser one diatonic, so that there are three genera; and these are the only ones used by Archytas.⁶²¹ For Ptolemy kept the enharmonic with just one characteristic | division,⁶²² but differentiated the chromatic into two, the soft and the tense, and similarly identified the tonic diatonic and posited two others as well, one softer than it and one more tense, in accordance with the ratios set out below. Thus he made the total number of genera six, of which the enharmonic is put together from 5:4, 24:23 and 46:45, the soft chromatic | from 6:5, 15:14 and 28:27, the tense chromatic from 7:6, 12:11 and 22:21, the soft diatonic from the ratios 8:7, 10:9 and 21:20, the soft entonic⁶²³ from 9:8, 8:7 and 28:27, and the tense diatonic from 10:9, 9:8 and 16:15.⁶²⁴ | For clarity's sake I have set out below the numbers in the six tetrachords, which are as follows:

Enharmonic	5:4, 24:23, 46:45
Soft chromatic	6:5, 15:14, 28:27
Tense chromatic	7:6, 12:11, 22:21
Soft diatonic	8:7, 10:9, 21:20
Soft entonic	9:8, 8:7, 28:27
Tense diatonic	10:9, 9:8, 16:15

Peculiar to the enharmonic and the chromatic is what is called the *pyknon*, when the two ratios at the lower end are jointly smaller than the remaining one;⁶²⁵ thus in the table of numbers set out above, | the ratios 24:23 and

⁶²¹ The last statement anticipates I.13, where Archytas' three divisions are described (one enharmonic, one chromatic and one diatonic). By saying that he used only three genera, Porphyry implies that other theorists recognised others as well, and he goes on to describe six of the systems defined and accepted by Ptolemy. But though many theorists identify more than three ways of dividing the tetrachord, they rarely say that there are more than three genera; they say that there are only three genera, but that there are several different forms of the chromatic and the diatonic (sometimes called *chroai*, 'shades' or 'nuances'). For Ptolemy and Porphyry too, the classification of genera into enharmonic, chromatic and diatonic is fundamental, but they sometimes allow themselves to refer to individual variants of the chromatic and the diatonic as 'genera' too, a usage which is uncommon elsewhere.

⁶²² The 'for' at the beginning of the sentence indicates that Porphyry is now explaining why he introduced the case of Archytas: 'I mentioned that point about Archytas because ...'

⁶²³ This is the division which Ptolemy (and Porphyry at 136.16 above, 142.2 below) calls the 'tonic diatonic'. Porphyry is, I think, unique in referring to it as the 'soft entonic', here and again at 154.7 and 157.25 below. It is not clear why Porphyry chose to diverge from Ptolemy's terminology in these passages. As Hagel points out, 'soft entonic' (*malakon entonon*) is a paradoxical expression, 'soft' referring to a lowering and 'entonic' to a raising of pitch. See Hagel (2009): 205 for this and further comments.

⁶²⁴ This account of Ptolemy's divisions, like 135.21–2 above, is not based on anything in this chapter of the *Harmonics*; it summarises the results Ptolemy reaches in I.15.

⁶²⁵ The passage concerned with the opening lemma ends with the tables in the previous paragraph. Here Porphyry quotes the beginning of the next passage, Ptol. *Harm.* 29.5–7.

- (30) ὁ μὲν ἐπὶ κγ' μετὰ τοῦ ἐπὶ μέ' ἐν τῷ ἐναρμονίῳ γένει ἐλάττων ἐστὶ τοῦ
- (137) ἐπὶ δ' λόγου πρὸς τῷ ὀξυτάτῳ φθόγγῳ τεταγμένου· ὁ δ' ἐπὶ ιδ' μετὰ τοῦ ἐπὶ κζ' ἐλάσσων ἐστὶ τοῦ ἐπὶ ε' ἐν τῷ μαλακῷ τῶν χρωμάτων· ὁ δ' ἐπὶ ια' μετὰ τοῦ ἐπὶ κα' ἐλάσσων τοῦ ἐπὶ ζ' λόγου ἐν τῷ συντόνῳ τῶν χρωματικῶν.
- (5) Τοῦ δὲ διατονικοῦ ἴδιόν ἐστι τὸ καλούμενον ἄπυκνον· ὅταν μὴ εἶς τῶν τριῶν λόγων μείζων γίνηται τῶν λοιπῶν δύο συναμφοτέρων. ἔστι δὲ καὶ τοῦτο δῆλον ἐκ τῆς προκειμένης τῶν ἀριθμῶν ἐκθέσεως. ἐλάττων γὰρ ἐπὶ τῶν λοιπῶν γενῶν ὁ μὲν ἐπὶ ζ' τοῦ ἐπὶ θ' καὶ τοῦ ἐπὶ κ' συναμφοτέρων· ὁ δ' ἐπὶ η' τοῦ ἐπὶ ζ' καὶ τοῦ ἐπὶ κζ' συναμφοτέρων· ὁ δ' ἐπὶ θ' τοῦ ἐπὶ η' καὶ τοῦ ἐπὶ ιε' συναμφοτέρων. καὶ ὁμοίως ἕκαστος αὐτῶν πρὸς τῷ ὀξυτάτῳ μεθ' ἑνὸς τῶν πρὸς τῷ ἐπομένῳ μείζων ἐστὶ τοῦ λοιποῦ.
- Ποιοῦνται δὲ καὶ τούτων αὐτῶν οἱ νεώτεροι πλείους διαφορὰς, ἀλλ' αὐτὸς τὰς Ἀριστοξενεῖους ὑπέγραψεν ἐχούσας οὕτως. τὸν τόνον διαιρεῖ
- (15) ὁ Ἀριστόξενος ποτὲ μὲν εἰς δύο ἴσα, ποτὲ δ' εἰς τρία, ποτὲ δ' εἰς τέσσαρα, ποτὲ δ' εἰς ὀκτώ. καὶ τὸ μὲν τέταρτον αὐτοῦ μέρος καλεῖ δέισιν ἐναρμόνιον, τὸ δὲ τρίτον δέισιν χρώματος μαλακοῦ, τὸ δὲ τέταρτον μετὰ τοῦ ὀγδόου δέισιν χρώματος ἡμιολίου, τὸ δ' ἡμιτόνιον κοινὸν τονιαίου χρώματος καὶ τῶν διατονικῶν γενῶν, ἐξ ὧν ὑφίσταται διαφορὰς τῶν
- (20) ἀμιγῶν γενῶν ἕξ, μίαν μὲν τὴν τοῦ ἐναρμονίου, τρεῖς δὲ τοῦ χρωματικοῦ μαλακοῦ τε καὶ ἡμιολίου καὶ τονιαίου, τὰς δὲ λοιπὰς δύο τοῦ διατονικοῦ, τὴν μὲν μαλακοῦ, τὴν δὲ συντόνου. τοῦ μὲν οὖν ἐναρμονίου γένους τὸ μὲν πρὸς τῷ βαρυτάτῳ καὶ ἐπόμενον διάστημα καὶ τὸ μέσον ἐκότερον ποιεῖ διέσεως ἐναρμονίου, τὸ δὲ λοιπὸν καὶ ἡγούμενον δύο τόνων, οἷον
- (25) ὑποκειμένου κατὰ τὸν τόνον ἀριθμοῦ τοῦ τῶν δώδεκα κατ' Ἀριστόξενον, ὥστε τὸ διὰ τεσσάρων διάστημα γίνεσθαι τοῦ τῶν λ' ἀριθμοῦ, τῶν μὲν τοῦ πυκνοῦ διαστημάτων ἐκότερον ποιεῖ τριῶν τῶν αὐτῶν, τὸ δὲ λοιπὸν κδ'· τοῦ δὲ μαλακοῦ χρώματος ἐκότερον μὲν τῶν τοῦ πυκνοῦ δια-

1 τεταγμένου Alexanderson τεταγμένῳ codd.

11 μείζων Wallis ἐλάσσων codd.

46:45 taken together in enharmonic are less than the ratio 5:4, which is placed next to the highest note; the ratios 15:14 and 28:27 taken together are less than the ratio 6:5 in the soft form of the chromatic; and the ratios 12:11 and 22:21 taken together are less than the ratio 7:6 in the tense form of the chromatic.

| Peculiar to the diatonic is what is called the *apyknon*, when no one of the three ratios is greater than the remaining two together.⁶²⁶ This too is clear from the table of numbers set out above. For in the remaining genera the ratio 8:7 is smaller than 10:9 and 21:20 taken together; the ratio 9:8 is smaller than 8:7 and 28:27 taken together; the ratio | 10:9 is smaller than 9:8 and 16:15 taken together; and similarly each of the intervals next to the highest note, taken together with one of those next to the 'following' note,⁶²⁷ is greater than the remaining ratio.

The more recent writers make several more distinctions than these, but Ptolemy wrote out only the Aristoxenian ones, which are as follows.⁶²⁸ Aristoxenus divides | the tone sometimes into two equal parts, sometimes into three, sometimes into four and sometimes into eight, and he calls the fourth part of it the enharmonic diesis, the third part a diesis of the soft chromatic, the fourth part together with the eighth part a diesis of the hemiolic chromatic, and the half-tone common to the tonic chromatic and the diatonic genera; and from these he posits distinctions between | six unmixed genera, one in the enharmonic, three in the chromatic – soft, hemiolic and tonic – and the remaining two in the diatonic – one of the soft diatonic and one of the tense.⁶²⁹ Then in the enharmonic genus he makes the 'following' interval – that is, the interval next to the lowest note – and the middle interval each consist of an enharmonic diesis, and the remaining, 'leading' interval of two tones. Thus | when one correlates the number 12 with the tone, as Aristoxenus does, so that the interval of a fourth is that of the number 30, he makes each of the intervals on the *pyknon* 3 of these units and the remaining interval 24. In the soft chromatic he makes each of the intervals of the *pyknon* a third part of a tone, and

⁶²⁶ Ptol. *Harm.* 29.7–9. A *pyknon* is something 'compressed', in harmonics a pair of intervals whose bounding notes are closely packed together; an *apyknon* is a pair of intervals that is in this sense 'non-compressed'.

⁶²⁷ Porphyry's expression is less than clear. He must mean to refer to a combination of the highest interval with either of the two lower ones in the same division; but the 'following' note is the lowest note in the tetrachord, and taken strictly his description would pick out only the lower of the two relevant intervals.

⁶²⁸ As the sequel shows, 'Aristoxenian' in this sentence means 'those of Aristoxenus himself'. The 'more recent writers' must be latter-day followers of Aristoxenus (as at 130.28 and 32), but we know nothing of the additions they made to his divisions.

⁶²⁹ See Aristox. *El. harm.* 21.31–27.14, 46.19–52.32.

- στημάτων ποιεῖ τριτημορίου τόνου, τὸ δὲ λοιπὸν ἑνὸς καὶ ἡμίσεος καὶ
- (30) τρίτου, οἷον ἐκείνων μὲν ἑκάτερον δ', τοῦτο δὲ κβ'· τοῦ δ' ἡμιολίου χρώματος τῶν μὲν τοῦ πυκνοῦ δύο διαστημάτων ἑκάτερον ποιεῖ τετάρτου καὶ ὀγδόου τόνου, τὸ δὲ λοιπὸν ἑνὸς καὶ ἡμίσεος καὶ τετάρτου, οἷον ἐκείνων μὲν ἑκάτερον δ' ἡμισυ, τὸ δὲ λοιπὸν κα'· τοῦ δὲ τονιαίου χρώ-
- (138) ματος τῶν μὲν τοῦ πυκνοῦ δύο διαστημάτων ἑκάτερον ἡμιτονίου ποιεῖ, τὸ δὲ λοιπὸν ἑνὸς τόνου καὶ ἡμίσεος, οἷον ἐκείνων μὲν ἑκάτερον ζ', τοῦτο δὲ ιη'. ἐπὶ δὲ τῶν λοιπῶν καὶ ἀπύκνων δύο γενῶν τὸ μὲν ἐπόμενον ἐν ἀμφοτέροις διάστημα τηρεῖ πάλιν ἡμιτονίου, τῶν δ' ἐφεξῆς ἐν μὲν τῷ
- (5) μαλακῷ διατονικῷ τὸ μὲν μέσον ἡμίσεος καὶ τετάρτου τόνου, τὸ δ' ἡγούμενον ἑνὸς καὶ τετάρτου, οἷον ζ', θ' καὶ ιε'. ἐν δὲ τῷ συντόνῳ διατονικῷ τὸ μὲν μέσον καὶ τὸ ἡγούμενον ἑκάτερον τόνου, τὸ δ' ἐπόμενον ἡμιτονίου, οἷον ζ' καὶ ιβ' καὶ ιβ'· ὡς ὑπόκειται τὸ σχῆμα τοὺς διπλασίους ἔχον τῶν εἰρημένων ἀριθμῶν.
- (10) Ἐλαβε δὲ τῶν εἰρημένων ἀριθμῶν τοὺς διπλασίους ὁ Πτολεμαῖος, ἵνα πάντας ἐξ ὅλων μονάδων ἔκθηται, δηλονότι τοῦ τονιαίου διαστήματος ὑποτεθέντος αὐτῷ ἐν μονάσιν κδ' ἀντὶ μονάδων ιβ' τῶν κατ' Ἀριστόξενον, ὃς καὶ περὶ τῶν εἰρημένων γενῶν λέγει που κατὰ λέξιν οὕτως.
- “Ἐκαστον τῶν τετραχόρδων εἰς ἑξ διαιρεῖται γένη, ὧν ἔστιν ἐν μὲν,
- (15) ὃ καλεῖται ἁρμονία, διέσει χρώμενον τῇ ἐλαχίστῃ, ἥτις ἐστὶ τέταρτον τόνου, τρία δὲ χρωματικά, ὧν τὸ μὲν βαρύτατον χρῆται διέσει τῇ καλουμένην χρωματικῇ· ἔστι δ' αὕτη τρίτον τόνου· τὸ δὲ μέσον ἄλλῃ διέσει

the remaining interval one plus a half plus | a third, so that each of the former is 4 and the latter is 22. In the hemiolic chromatic he makes each of the two intervals of the *pyknon* a quarter plus an eighth of a tone, and the remaining interval one plus a half plus a quarter, so that each of the former is $4\frac{1}{2}$ and the latter is 21. In the tonic chromatic he makes each of the two intervals of the *pyknon* consist of a half-tone, and the remaining interval of one and a half, so that each of the former is 6 and the latter is 18. In the cases of the two remaining genera, which are *apykna*, he keeps the 'following' interval as consisting of a half-tone in both, and of those that succeed it in the | soft diatonic he makes the middle one consist of a half plus a quarter of a tone and the 'leading' one of one and a quarter, giving 6, 9 and 15; and in the tense diatonic he makes the middle and the 'leading' interval a tone each, and the 'following' one a half-tone, giving 6, 12, 12. A diagram is set out below, with the numbers that have been specified doubled.⁶³⁰

[138D]

| Ptolemy took the doubles of the numbers mentioned so that he could set all of them out in whole numbers, thus obviously representing the interval of a tone as consisting of 24 units instead of the 12 used by Aristoxenus, who speaks of the genera we have described in precisely the following words.⁶³¹

Each of the tetrachords is divided into six genera,⁶³² of which one, | called *harmonia*,⁶³³ uses the smallest diesis, which is a quarter of a tone; three are chromatic, of which the lowest uses the diesis called 'chromatic', which is a third of a tone, the intermediate one uses another diesis, which is called

⁶³⁰ This paragraph is almost entirely a direct quotation of Ptol. *Harm.* 29.9–30.2. The only significant difference is that the numbers used by Ptolemy are twice those given by Porphyry, which Ptolemy and others also use when discussing Aristoxenus elsewhere. Porphyry explains in the next paragraph why Ptolemy has doubled the numbers here. In view of the present sentence's allusion to doubling them, and of the fact that there is no diagram in the Porphyry MSS, he must mean that the table of numbers is set out in Ptolemy's text, as indeed it is. As Ptolemy presents them, they are these:

Enharmonic: 48, 6, 6
Soft chromatic: 44, 8, 8
Hemiolic chromatic: 42, 9, 9
Tonic chromatic: 36, 12, 12
Soft diatonic: 30, 18, 12
Tense diatonic: 24, 24, 12.

⁶³¹ The thesis that Aristoxenus divided the tone into 12 units is common in later sources. The best evidence for it in his surviving texts is at *El. harm.* 25.11–26.7; but the passage quoted below by Porphyry seems to have no bearing on the matter.

⁶³² The description of the six divisions as 'genera', rather than as including variants of the three that are standardly recognised, is uncharacteristic of Aristoxenus; cf. n. 621 above. It may be an indication that Porphyry found the passage in an intermediate source which had not altogether preserved Aristoxenus' terminology.

⁶³³ In such contexts the name *harmonia* refers to the enharmonic genus.

- χρηται τῇ καλουμένη ἡμιολίᾳ, ἐπειδὴ μίαν ἐναρμόνιον δίεσιν καὶ ἡμισυ
 συνέστη τὸ διάστημα αὐτῆς· τὸ δὲ τρίτον χρῶμα σύντονόν ἐστιν καθ’
 (20) ἡμιτόνιον συνεστὸς καὶ οὐ δίεσιν, καὶ τὸ πυκνὸν μέχρι τούτου πρόεισι.
 μέχρι γὰρ τούτου τὸ ἐν διάστημα τῶν δύο μείζον ὑπάρχει, εἴτ’ ἀπὸ τού-
 του εἰς ἴσα διαιρεῖται τὸ τετράχορδον. λοιπὰ γὰρ δύο γένη ἐστὶ δια-
 τονικὰ ἀμφότερα. κατὰ μέντοι τὸ ἀνειμένον, ὡς εἴρηται, εἰς ἴσα τέμνε-
 (25) ται τὸ τετράχορδον κατὰ τὸν ὀξύτερον τῶν κινουμένων φθόγγων. τὸ
 γὰρ ἀπὸ ὑπάτης μέσων λόγου χάριν ἐπὶ λιχανὸν ἴσον γίνεται τῷ ἀπὸ
 λιχανοῦ ἐπὶ μέσῃν, ὅπερ ἐπ’ οὐδενὸς ἦν τῶν πρώτων γενῶν καὶ διὰ τοῦτο
 ἐπ’ αὐτῶν τὸ πυκνὸν διέμενε. κατὰ δὲ τὸ λοιπὸν γένος, ὃ δὴ καὶ αὐτὸ
 διατονικόν ἐστι καὶ συντονώτερον, ὀξυτέρα ἔτι γίνεται ἡ λιχανός, ὥστε
 τονιαῖον μόνον εἶναι τὸ ἀπ’ αὐτῆς διάστημα ἐπὶ μέσῃν.”

ΙΥ’

Οὗτος μὲν οὖν κἀνταῦθα φαίνεται μηδὲν τι τοῦ λόγου φροντίσας,
 ἀλλὰ τοῖς μεταξὺ μόνοις τῶν φθόγγων διορίσας τὰ γένη καὶ μὴ ταῖς
 αὐτῶν πρὸς ἀλλήλους ὑπεροχαῖς, τὰ μὲν αἷτια τῶν διαφορῶν ὡς ἀναίτια (5)
 καὶ τὸ μηθὲν καὶ πέρατα μόνον παραλιπών, τοῖς δὲ ἁσωμάτοις καὶ κενοῖς
 προσάψας τὰς παραβολάς. διὰ τοῦτο δὲ οὐδὲν αὐτῷ μέλει δίχα διαιροῦντι
 σχεδὸν πανταχῇ τὰς ἐμμελείας, τῶν ἐπιμορίων αὐτῶν μηδαμῶς τὸ
 τοιοῦτον ἐπιδεχομένων. Ἀρχύτας δὲ ὁ Ταραντῖνος μάλιστα τῶν Πυ-
 θαγορείων ἐπιμεληθεὶς μουσικῆς πειρᾶται μὲν τὸ κατὰ τὸν λόγον ἀκό- (10)
 λουθον διασῶζειν, οὐκ ἐν ταῖς συμφωνίαις μόνον, ἀλλὰ καὶ ταῖς τῶν
 τετραχόρδων διαιρέσεσιν, ὡς οἰκείου τῇ φύσει τῶν ἐμμελῶν ὄντος
 τοῦ συμμετρου τῶν ὑπεροχῶν. ταύτη δ’ ὅμως τῇ προθέσει χρησά-
 μενος εἰς ἓνα μὲν καὶ τέλεον αὐτῆς φαίνεται διαμαρτάνων, ἐν δὲ τοῖς
 πλείστοις τοῦ μὲν τοιοῦτου περικρατῶν, ἀπάδων δὲ σαφῶς τῶν ἄντικρυς (15)
 ἤδη ταῖς αἰσθήσεσιν ὠμολογημένων, ὡς αὐτίκα εἰσόμεθα ἐκ τῆς κατ’
 αὐτὸν τῶν τετραχόρδων διαιρέσεως. τρία μὲν τοίνυν οὗτος ὑφίσταται

18 <κατά> ante μίαν addendum coni. Alexanderson 25 μέσον g
 κεφαλαίου add. p

29 ἀπ’] ἐπ’ p τέλος τοῦ ιβ’

'hemiotic', since its interval amounts to one and a half enharmonic dieses,⁶³⁴ and the third is the tense chromatic, constituted with | half-tones and not dieses; and up to this point the *pyknon* increases. For up to this point the one interval is greater than the two, but after this point the tetrachord is divided into equal parts.⁶³⁵ For both the remaining genera are diatonic. The 'slackened' diatonic,⁶³⁶ as has been said, divides the tetrachord into equal parts at the higher of the movable notes; for | the interval from *hypatē mesōn* to *lichanos*, for instance, is equal to that from *lichanos* to *mesē*, which was not the case in any of the preceding genera; and for that reason the *pyknon* is preserved in them. In the remaining genus, which is also diatonic, and more tense, the *lichanos* is even higher, so that the interval from it to *mesē* is only a tone.⁶³⁷

Chapter 13

<From⁶³⁸ these facts too, therefore, it seems that Aristoxenus gave no thought to ratio, but defined the genera only by what lies between the notes, and not by their differences considered in relation to one another, passing over the causes of the differences as being no causes, as nothings, as mere limits, while attaching the distinctions to things that are bodiless and empty. Hence it is of no concern to him that in almost all cases he is dividing melodic distances in half, though those that are epimoric by no means admit such treatment.

But Archytas of Tarentum, of all the Pythagoreans the most dedicated to the study of music, tried to preserve what follows the principles of reason not only in the concords but also in the divisions of the tetrachords, believing that commensurability of the excesses is a characteristic of the nature of melodic intervals. But though he sets off from this presupposition, at several points he plainly falls hopelessly short of it; and though in most cases he is well in control of this sort of thing, he is patently out of tune with what has already been straightforwardly accepted by the senses, as will be seen at once from the division of the tetrachords that he proposes. He posits three

⁶³⁴ 'Hemiotic' (*hēmīolios*) means 'half and whole'.

⁶³⁵ That is, in the cases so far described, the highest interval of the tetrachord is greater than the other two taken together, but in the next division that Aristoxenus recognises they are equal. Aristoxenus regularly treats the two lowest intervals of the tetrachord as a virtually inseparable pair, so that the tetrachord falls naturally into two main parts.

⁶³⁶ 'Slackened' translates *aneimenon*; the term indicates a lowering of pitch. This is the system which Porphyry, and Aristoxenus elsewhere, call the 'soft' (*malakon*) diatonic.

⁶³⁷ Aristox. *test.* 95 Da Rios.

⁶³⁸ There are no lemmata in this chapter; after some hesitation I have chosen to supply the whole of Ptolemy's chapter, so that readers can make their own comparisons, bracketing it to show that it is not in the source. The first part of Porphyry's passage (138.30–139.26) quotes (or sometimes paraphrases) the first part of Ptolemy's (*Harm.* 30.3–19), with a liberal sprinkling of inserted additions. In the second and final part (139.27–140.31) Porphyry adopts a different approach; instead of paraphrasing Ptolemy's text, he restricts himself to an explanation of the method by which Ptolemy arrived at the numbers he uses at the end of his chapter (*Harm.* 31.6–18), as the terms of Archytas' ratios (for a comparable discussion see 130.8–21 above).

γένη, τό τε ἑναρμόνιον καί τὸ χρωματικόν καί τὸ διατονικόν· ἐκάστου δὲ αὐτῶν ποιεῖται τὴν διαίρεσιν οὕτως. τὸν μὲν γὰρ ἐπόμενον λόγον ἐπὶ τῶν τριῶν γενῶν τὸν αὐτὸν ὑφίσταται καὶ ἐπὶ κζ', τὸν δὲ μέσον ἐπὶ (20) μὲν τοῦ ἑναρμονίου ἐπὶ λε', ἐπὶ δὲ τοῦ διατονικοῦ ἐπὶ ζ', ὥστε καὶ τὸν [31] ἡγούμενον τοῦ μὲν ἑναρμονίου γένους συνάγεσθαι ἐπὶ δ', τοῦ δὲ διατονικοῦ ἐπὶ η'. τὸν δὲ ἐν τῷ χρωματικῷ γένει δεύτερον ἀπὸ τοῦ ὀξύτατου φθόγγου λαμβάνει διὰ τοῦ τὴν αὐτὴν θέσιν ἔχοντος ἐν τῷ διατονικῷ. φησὶ γὰρ λόγον ἔχειν τὸν ἐν τῷ χρωματικῷ δεύτερον ἀπὸ τοῦ ὀξύτατου πρὸς τὸν ὅμοιον τὸν ἐν τῷ διατονικῷ τὸν τῶν σνς' πρὸς τὰ [5] σμγ'. συνίσταται δὴ τὰ τοιαῦτα τετράχορδα κατὰ τοὺς ἐκκειμένους λόγους ἐν πρώτοις ἀριθμοῖς τούτοις. ἂν γὰρ τοὺς μὲν ὀξύτάτους τῶν τετραχόρδων ὑποσθησώμεθα ραβιβ', τοὺς δὲ βαρυτάτους κατὰ τὸν ἐπίτριτον λόγον τῶν αὐτῶν βιβ', ταῦτα μὲν ποιήσει τὸν ἐπὶ κζ' πρὸς τὰ α'λμδ' καὶ τοσούτων ἔσονται πάλιν ἐν τοῖς τρισὶ γένεσιν οἱ δευτέ- [10] ροι ἀπὸ τῶν βαρυτάτων. τῶν δ' ἀπὸ τοῦ ὀξύτατου δευτέρων ὁ μὲν τοῦ ἑναρμονίου γένους ἔσται αωι'. ταῦτα γὰρ πρὸς μὲν τὰ α'λμδ' ποιεῖ τὸν ἐπὶ λε' λόγον, πρὸς δὲ τὰ ραβιβ' τὸν ἐπὶ δ'· ὁ δὲ τοῦ διατονικοῦ γένους τῶν αὐτῶν ἔσται αψα'. καὶ ταῦτα γὰρ πρὸς μὲν τὰ α'λμδ' τὸν ἐπὶ ζ' ποιεῖ λόγον, πρὸς δὲ τὰ ραβιβ' τὸν ἐπὶ η'· ὁ δὲ τοῦ χρωματικοῦ [15] καὶ αὐτὸς ἔσται τῶν αὐτῶν αψιιβ'. ταῦτα γὰρ λόγον ἔχει πρὸς τὰ αψα' ὃν τὰ σνς' πρὸς τὰ σμγ'. ὑπογέγραπται δὲ καὶ ἡ τούτων τῶν ἀριθμῶν ἑκθεσις ἔχουσα οὕτως.

ἑναρμόνιον	χρωματικόν	διατονικόν
ραβιβ'	ραβιβ'	ραβιβ'
ἐπὶ δ'		ἐπὶ η'
αω'	αψβ'	αψα'
ἐπὶ λε'		ἐπὶ ζ'
α'λμδ'	α'λμδ'	α'λμδ'
ἐπὶ κζ'	ἐπὶ κζ'	ἐπὶ κζ'
βιβ'	βιβ'	βιβ'

- (30) Οὗτος μὲν δὴ κἀνταῦθα φαίνεται μηδέν τι τοῦ λόγου φροντίσας ὥς ἐπὶ
- (139) τῶν συμφωνιῶν, ἀλλὰ τοῖς μεταξὺ μόνους τῶν φθόγγων διαστήμασιν, ὥς τοπικοῖς οὔσι χρησάμενος διώρισε τὰ γένη, καὶ οὐ ταῖς τῶν φθόγγων πρὸς ἀλλήλους ὑπεροχαῖς, ἐξ ὧν τὸ κατὰ δύναμιν διάστημα θεωρεῖται. τοῦτο δ' ἐστὶν οὐδὲν ἕτερον ἢ δύο φθόγγων ἀνομοίων ἢ κατὰ πλη-
(5) κότητα ποιά σχέσις, ὃ ἐστὶ λόγος. καὶ τὰ μὲν αἷτια τῶν διαφορῶν ὥς

genera, the enharmonic, the chromatic and the diatonic, and he makes his division of each of them in the following way. He makes the 'following' ratio the same in all three genera, 28:27; the middle one in the enharmonic 36:35 and in the diatonic 8:7, so that the 'leading' interval in the enharmonic turns out to be 5:4 and in the diatonic 9:8. In the chromatic genus he locates the note second from the highest by reference to that which has the same position in the diatonic. For he says that the second note from the highest in the chromatic stands to the corresponding note in the diatonic in the ratio of 256:243. Such tetrachords, on the basis of the ratios set out, are constituted in their lowest terms by the following numbers. If we postulate that the highest note of each tetrachord is 1512, and the lowest, in epitritus ratio with this, is 2016, this latter term will make the ratio 28:27 with 1944, and that will be the quantity of the second note from the lowest in all three genera. As to the second note from the highest, that in the enharmonic genus will be 1890, since this makes with 1944 the ratio 36:35, and with 1512 the ratio 5:4. The corresponding note in the diatonic genus will be 1701, since that makes with 1944 the ratio 8:7, and with 1512 the ratio 9:8. The corresponding note in the chromatic genus will be 1792, since this has a ratio to 1701 as is 256 to 243. The table of these numbers is set out below.

Enharmonic	Chromatic	Diatonic
1512	1512	1512
5:4	32:27	9:8
1890	1792	1701
36:35	243:224	8:7
1944	1944	1944
28:27	28:27	28:27
2016	2016	2016 >

Ptol. *Harm.* 30.3–31.18

| From these facts too, therefore, it seems that Aristoxenus gave no thought to ratio, as in the case of the concords, but defined the genera only by the intervals between the notes, which he treated as spatial, and not by the excesses⁶³⁹ of the notes considered in relation to one another, through which the character of an interval is derived. This is nothing other than the specific quantitative relation between two dissimilar notes, | which is a ratio. He passed over the causes of the differences as being no causes,

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⁶³⁹ *Hyperochai*, whose relational character is in this case explicitly specified.

- ἀναίτια καὶ ὥς [μὴ] θέσεις καὶ πέρατα παρέλιπε, τοῖς δ' ἄσωμάτοις καὶ κενοῖς ὥσπερ σώμασι μεταξὺ προσῆψε τὰς συγκρίσεις καὶ σχέσεις τῶν φθόγγων. διὰ τοῦτο οὐδὲν αὐτῷ μέλει δίχα διαιροῦντι σχεδὸν πανταχῇ τὰς ἐμμελείας, ὥς διὰ τῶν προκειμένων διεῖλεν εἰς ζ' καὶ ζ' καὶ η' καὶ (10) η' καὶ θ' καὶ θ' καὶ ιβ' καὶ ιβ' καὶ κδ' καὶ κδ' καὶ λ' καὶ λ', τῶν ἐπιμορίων λόγων μηδαμῶς τὸ τοιοῦτον ἐπιδεχομένων. ἐπιμόριος γὰρ λόγος οὐδαμῶς εἰς δύο λόγους ἴσους διαιρεῖται, καθ' ὥς ἀνώτερον ἀπεδείχθη.
- Ἀρχύτας δ' ὁ Ταραντῖνος ἐξῆς τῶν Πυθαγορείων ἦν· οὗτος δὲ μάλιστα ἐπιμεληθεὶς μουσικῆς πειρᾶται τὸ κατὰ τὸν λόγον ἀκόλουθον δια- (15) σῶσαι οὐκ ἐν ταῖς συμφωνίαις μόνον ἐν ἐπιτρίτῳ καὶ ἡμιολίῳ καὶ τοῖς λοιποῖς, ἀλλὰ καὶ ταῖς τῶν τετραχόρδων σχέσεσιν, ὥς οἰκείου τῇ φύσει τῶν ἐμμελῶν φθόγγων ὄντος τοῦ συμμετρου τῶν ὑπεροχῶν, ὥς ὁ τόνος τοῦ διὰ πέντε πρὸς τὸ διὰ τεσσάρων ὑπεροχὴ ἐστίν. ταύτη δ' ὁμῶς τῇ προθέσει χρώμενος τῇ διὰ λόγων ἀποδείξει εἰς ἕνια τέλεον αὐτῆς, τῆς

and as mere positions⁶⁴⁰ and limits, and attached the comparisons and the relations between the notes to bodiless and empty things, as if they were bodies lying between them. Hence it is of no concern to him that in almost all cases he is dividing melodic distances in half, as in the cases set out he divided them into 6 and 6, 8 and 8, 9 and 9, 12 and 12, 24 and 24, 30 and 30,⁶⁴¹ though epimoric ratios by no means admit such treatment. For an epimoric ratio can in no way be divided into two equal ratios, as was demonstrated above.

Archytas of Tarentum came next after the Pythagoreans.⁶⁴² He was especially dedicated to the study of music, and tried to preserve what follows the principles of reason | not only in the concords (in the epitritic, the hemiolic and the other ratios) but also in the relations inside the tetrachords, believing that commensurability of the excesses is characteristic of the nature of melodic notes (as for instance the tone is the excess of the fifth over the fourth).⁶⁴³ But though he sets off from this presupposition in his exposition by means of ratios, at several points | he plainly falls

⁶⁴⁰ The Porphyry MSS read *mē thesēis*, 'not positions'; Ptolemy has *mēthen*, 'nothing'. If we accept *thesēis*, 'positions', the negative must be deleted; alternatively we might suppose that *mē thesēis* is a scribal error that has supplanted *mēthen*.

⁶⁴¹ The numbers are those used in 1.12 by Ptolemy, not by Porphyry, to represent the intervals of Aristoxenus' divisions; see 138.10–14 above. Pairs of intervals of 6, 8, 9 and 12 units each appear as the lowest two intervals in the first four divisions, the enharmonic and the chromatic; 30 is the highest interval of the fifth division, the 'slackened' or 'soft' diatonic, paired with the two lower intervals which add up to the same amount; and a pair amounting to 24 units each appears in the sixth division, the tense diatonic. Porphyry asserts (and Ptolemy implies) that the intervals formed from the two intervals of each pair taken together should have epimoric ratios, and hence cannot be divided equally, though they are not in fact 'melodic' intervals in the usual sense, that is, individual steps of the scale. The assertion is legitimate if two conditions are fulfilled. First, Porphyry must subscribe to a principle used by Ptolemy in 1.15, that in each case the ratio of the fourth must first be divided into two epimoric ratios, of which one will then be subdivided into two smaller epimorics. Secondly, he must assume that in the first four of Aristoxenus' systems, as in Ptolemy's enharmonic and chromatic, the intervals formed at the second of these stages are the two lowest intervals, constituting the *pyknon*; that the fifth division corresponds to Ptolemy's soft diatonic, in which the first stage of the division separates the highest interval from the others; and that the sixth system corresponds to Ptolemy's tense diatonic, in which the intervals formed at the second stage are the two highest.

⁶⁴² This description of Archytas is surprising, since he is regularly treated as a Pythagorean himself; Porphyry describes him as such at 56.2–3. See Introduction n. 61. Possibly the text should be emended to give the sense 'next after the first Pythagoreans'.

⁶⁴³ The remark in parentheses, one of Porphyry's interventions into Ptolemy's text, seems rather odd. The 'excess' to which Ptolemy refers is, as usual, that by which the greater term of a ratio exceeds the smaller; it is required to be 'commensurable' with each of them – a 'simple part' or unit fraction of each – and the ratio must consequently be epimoric. This is quite different from the sense in which the tone is the 'excess' of a fifth over a fourth. Since the interval of a tone is 'melodic', it must indeed fulfil the conditions that Ptolemy lays down, but that does not appear to be what Porphyry means. (Several of the other non-Ptolemaic interjections in this passage are sufficiently banal or obtuse to arouse the suspicion that the text here is infected with interpolations for which Porphyry is not responsible; but we cannot be sure.)

- (20) προθέσεως αὐτῆς, φαίνεται διαμαρτάνων, ὅτι μὴ πᾶσιν ἐπιμορίοις ἀριθμοῖς κέχρηται. ἐν δὲ τοῖς πλείστοις τοῦ μὲν τοιοῦτου περικρατῶν, τούτέστι τοῦ ἐπιμορίου εἶναι τοὺς ἀριθμούς καὶ συμμετρους εἶναι τὰς ὑπεροχάς· ἀπαγορεύων δὲ σαφῶς τῶν ἀντικρυς ἤδη ταῖς αἰσθήσεσιν ὠμολογημένων. μάχεται γὰρ τὰ φαινόμενα τῇ κατ' αὐτὸν τῶν τετραχόρδων διαιρέσει καὶ γίνεται τοῦτο διὰ τῶν ἐξῆς δῆλον ἐκ τῶν ὑποτεταγμένων τῆς διαιρέσεως ἀριθμῶν, οὓς εὔρεν οὕτως.
- Ἐκκειμένον γὰρ τοῦ διὰ τεσσάρων λόγου ἐν πυθμέσιν ἀριθμοῖς τῷ δ' καὶ γ', βαρυτάτου μὲν ὄντος τοῦ δ' ὡς ὑπάτης ὑπάτων, ὀξυτέρου δὲ τοῦ γ' ὡς ὑπάτης μέσων, διὰ τὸ τοὺς ὀξυτέρους φθόγγους ἐν τοῖς ἐλάττωσιν
- (30) ἀριθμοῖς τάττεσθαι· ἀνάγκη τῆς παρυπάτης ἐν ἐπὶ κζ' λόγῳ οὕσης ἐν τοῖς τρισὶ γένεσιν ἐναρμονίῳ, χρωματικῷ καὶ διατονικῷ· τοῦτο γὰρ Ἀρχύτας ὑπέθετο· τὴν ὑπάτην ἔχειν κη', τούτέστι τὸν τῶν κη' μορίων ἀριθμόν, ἵνα σχῇ τὴν παρυπάτην καὶ τὸ εἰκοσθεβδόμον αὐτῆς, ὡς εἶναι βαρυτέραν τῷ εἰκοσθεβδόμῳ τὴν ὑπάτην τῆς παρυπάτης. ἐπεὶ οὖν δεῖ
- (140) τὴν ὑπάτην ἔχειν κη' καὶ ἔστι τέσσαρα ἐπτάκις, ἐπτάκις ἄρα γινομένη γ' κα', ἔσται οὖν ἡ μὲν ὑπάτη κη', ἡ δὲ παρυπάτη κζ', ἡ δ' ὑπάτη τῶν μέσων κα', ἵνα ὁ κη' πρὸς τὸν κα' τὸν ἐπίτριτον ἔχη λόγον. ἐπεὶ οὖν δεῖ τὴν παρυπάτην τῆς λιχανοῦ κατὰ τὴν Ἀρχύτου δόξαν κατὰ τὸ ἐναρμόνιον ποιεῖν ἐπὶ λε' λόγον, πρῶτος δ' ὁ λς' ποιεῖ τὸν ἐπὶ λε' λόγον, δεῖ ἄρα τὸν κζ' ἐπ' ἄλλον γενόμενον ἔχειν λς'· τετράκις δὲ γενόμενος ἴσχει λς'· πάντα ἄρα τετράκις καὶ γίνονται οἱ ἀριθμοὶ ριβ' ρη' πδ' καὶ τὸ ἐπὶ λε' ὁ ρη' τοῦ ρε'. ὡς γὰρ λς' πρὸς λε', οὕτως ρη' πρὸς ρε'· ἔσονται ἄρα τοῦ ἐναρμονίου τετραχόρδου οἱ ἀριθμοὶ ριβ' ρη' ρε' πδ'.
- (10) πάλιν ἐπειδὴ δεῖ κατὰ τὴν Ἀρχύτου δόξαν τὴν παρυπάτην τῆς λιχανοῦ ἐν τῷ διατονικῷ γένει ἐπὶ ζ' εἶναι, δεῖ ἄρα τὸν ρη' ὀγδοὺν ἔχειν ἀριθμὸν ὄντα τῆς παρυπάτης, ἵνα γένηται ἐπὶ ζ' τῆς λιχανοῦ δις γενόμενος ἴσχει η'· ἔσται ἄρα ἐν τῷ διατονικῷ γένει πάντων δις γενομένων τῶν προεκτεθέντων ἀριθμῶν ἡ μὲν ὑπάτη ὑπάτων σκδ', ἡ δὲ παρυπάτη σισ',
- (15) ἡ δὲ λιχανὸς ἡ μὲν ἐναρμόνιος σι', ἡ δὲ διατονικὴ ρπθ'. ὡς γὰρ ἡ πρὸς ζ', οὕτως σισ' πρὸς ρπθ', οὗ ἦν ἐπὶ ζ' ὁ σισ'· ὡς εἶναι τοῦ ἐναρμονίου

1 τέσσαρα ἐπτάκις Düring δ'ζ' V¹⁸⁷ τεταρ' ζ' ceteri 2 γ' κα' Wallis ζ' κη' codd.
8 ρε^{sec}·] λε' g 9 ριβ' ιβ' G ὁ ιβ' p 11 ὀγδοον] ὀκτώ vel ἡ Alexanderson

7 πάντας V¹⁸⁷ G
15 λιχανή codd.

hopelessly short of it – that is, of the presupposition itself – since not all the numbers he uses are epimoric;⁶⁴⁴ and though in most cases he is well in control of this sort of thing – that is, that the numbers should be epimoric and the differences commensurable – his statements are plainly at odds with what has already been straightforwardly accepted by the senses. For the phenomena conflict with his division of the tetrachords; | and in what follows this becomes clear from the numbers involved in the division, set out below.⁶⁴⁵ Ptolemy works them out in the following way.

When the ratio of the fourth is expressed in its lowest terms, 4 and 3, with the 4 being the lowest <note>, for instance *hypatē hypatōn*, and the 3 the highest, for instance *hypatē mesōn* (because the higher notes are correlated with | the smaller numbers),⁶⁴⁶ then since *parhypatē* is in the ratio 28:27 in all three genera,⁶⁴⁷ enharmonic, chromatic and diatonic (for that is what Archytas laid down), it is necessary that *hypatē* is 28, that is, the number made up of 28 units, in order that it may contain *parhypatē* and a twenty-seventh part of it, given that *hypatē* is lower by a twenty-seventh than *parhypatē*. Therefore since *hypatē* must be 28 and is 7 times 4, while 7 times 3 is 21, *hypatē* will then be 28, *parhypatē* 27, and *hypatē mesōn* 21, in order that 28 may stand to 21 in epitritus ratio.

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Since in the enharmonic, in Archytas' opinion, *parhypatē* must | make the ratio 36:35 with *lichanos*, and since 36 is the first number that makes this ratio, the number 27 must contain 36 in relation to some other number. When it is multiplied by 4 it contains 36;⁶⁴⁸ so everything is multiplied by 4, giving the numbers 112, 108, 84; and 108 is in the ratio 36:35 to 105. For as 36 is to 35, so is 108 to 105. Thus the numbers of the enharmonic tetrachord will be 112, 108, 105, 84.

| Again, since in Archytas' opinion *parhypatē* in the diatonic genus must stand to *lichanos* in the ratio 8:7, the number 108, that of *parhypatē*, must have an eighth, so that it can be in the ratio 8:7 with *lichanos*. When multiplied by 2 it has an eighth. Then in the diatonic genus, when all the numbers set out above are multiplied by 2, *hypatē hypatōn* will be 224, *parhypatē* 216, | the enharmonic *lichanos* will be 210 and the diatonic *lichanos* 189, since as 8 is to 7, so is 216 to 189, to which 216 is in the ratio

⁶⁴⁴ This must be intended to mean that they do not all stand in epimoric ratios to their immediate neighbours.

⁶⁴⁵ I.e. in the table at the end of Ptolemy's chapter.

⁶⁴⁶ Ptolemy and Porphyry adopt this form of representation in order to make the numbers correspond to lengths of string on the monochord and similar instruments.

⁶⁴⁷ That is, this is the ratio between it and *hypatē hypatōn* (which is referred to in the immediate sequel simply as *hypatē*).

⁶⁴⁸ I.e. $27 \times 4 (=108)$ contains 36 as a factor.

- ἀριθμούς σκδ' σις' σί' ρξη', τοῦ δὲ διατονικοῦ σκδ' σις' ρπθ' ρξη'.
- πάλιν ἐπεὶ δεῖ κατὰ τὴν Ἀρχύτου δόξαν τὴν λιχανὸν τοῦ διατονικοῦ
 πρὸς τὴν τοῦ χρώματος λιχανὸν λόγον ἔχειν τὸν τῶν σμγ' πρὸς τὰ σνς',
 (20) δεῖ ἔτι τὸν ρπθ' ἐπὶ τινὰ ἀριθμὸν γενόμενον ἔχειν σμγ' μέρος ἢ ἀπαρτί-
 ζειν παρὰ τῶν σμγ'· ἐννεάκις δὲ γενόμενος ὁ ρπθ' ποιεῖ τὸν αψα', μέρος
 ἔχοντα σμγ' τὸν ζ'· ἐπτάκις γὰρ ἄρα ποιήσαντες τὸν σνς' ἔξομεν ἀριθ-
 μὸν αψιβ', ὄντα λιχανὸν χρωματικὴν. ἀκολουθῶς ἄρα ἐπεὶ ἐννεάκις
 γέγονεν ὁ ρπθ', ποιῆσαι δεῖ τοὺς ἀριθμούς ἐννεάκις, τῶν τε τῆς ὑπάτης
 (25) ὑπάτων καὶ τῶν τῆς παρυπάτης καὶ τῶν τῆς ὑπάτης μέσων. ἔσται οὖν
 ὑπάτη μὲν ὑπάτων ἐν τοῖς τρισὶ γένεσιν ὁ βις'· παρυπάτη δὲ αλμδ'·
 καὶ αὕτη ἐν τοῖς τρισὶ γένεσιν· λιχανὸς δ' ὑπάτων ἐν μὲν ἀρμονίᾳ ρωι',
 ἐν δὲ χρώματι αψιβ', ἐν δὲ διατόνῳ αψα'· ὑπάτη δὲ μέσων αψιβ' ἐν
 τοῖς τρισὶ γένεσιν, ὃν χωρὶς ἀποδείξεως ἔλαβεν ὁ Πτολεμαῖος ἐστῶτα
 (30) καὶ τηροῦντα τὸν ἐπίτριτον λόγον πρὸς τὰ βις'. ὑπογέγραπται δὲ καὶ
 ἡ τούτων τῶν ἀριθμῶν ἔκθεσις ἔχουσα οὕτως.

ἐναρμόνιον	χρωματικόν	διατονικόν
αψιβ'	αψιβ'	αψιβ'
ἐπὶ δ'		ἐπὶ η'
ρω'	αψιβ'	αψα'
ἐπὶ λε'		ἐπὶ ζ'
αλμδ'	αλμδ'	αλμδ'
ἐπὶ κζ'	ἐπὶ κζ'	ἐπὶ κζ'
βις'	βις'	βις'

(141)

18'

[32] Παρὰ μὲν δὴ τὴν πρόθεσιν ὡς ἔφαμεν αὐτῷ συνεστάθη τὸ χρωματι-
 κὸν τετράχορδον—ὁ γὰρ τῶν αψιβ' ἀριθμὸς οὔτε πρὸς τὸν τῶν αψιβ'
 ποιεῖ λόγον ἐπιμόριον, οὔτε πρὸς τὸν τῶν αλμδ'—παρὰ δὲ τὴν ἀπὸ
 τῆς αἰσθήσεως ἐνάργειαν τὸ τε χρωματικόν καὶ τὸ ἐναρμόνιον. τὸν τε
 γὰρ ἐπόμενον λόγον τοῦ συνήθους χρωματικοῦ μείζονα καταλαμβάνομεν [5]
 τοῦ ἐπὶ κζ' καὶ τὸν ἐν τῷ ἐναρμονίῳ πάλιν ἐπόμενον τῶν ἐν τοῖς ἄλλοις
 γένεσιν ὁμοίων ἐλάττονα πολλῶ φαινόμενον ἴσον αὐτοῖς ὑποτίθεται, καὶ
 πρὸς τούτοις ἐλάττονα αὐτοῦ τὸν μέσον ἐν ἐπὶ λε' λόγῳ τιθέμενος, ἐκμε-
 λοῦς ἄντικρυς τοῦ τοιούτου πανταχῇ γινομένου, καθ' ὃ τὸ πρὸς τῷ βαρυ-
 τάτῳ μέγεθος τοῦ μέσου συνίσταται μείζον. ταῦτα μὲν δὴ δοκεῖ τῷ [10]

8:7. Thus the numbers of the enharmonic are 224, 216, 210, 168, and those of the diatonic are 224, 216, 189, 168.

Again, since in Archytas' opinion the *lichanos* of the diatonic must stand to the *lichanos* of the chromatic in the ratio 243:256, | the number 189 must contain 243 in relation to some other number (in other words it must be divisible by 243); and when 189 is multiplied by 9 it makes 1701, which has 7 as a two-hundred-and-forty-third part. Then when we multiply 256 by 7 we shall have the number 1792, this being the chromatic *lichanos*. Consequently, since 189 was multiplied by 9, we must multiply all the numbers by 9 – those of *hypatē* | *hypatōn*, *parhypatē* and *hypatē mesōn*. In all three genera *hypatē hypatōn* will therefore be 2016, and *parhypatē* will be 1944, again in all three genera. In enharmonic, *lichanos hypatōn* will be 1890, in chromatic 1792 and in diatonic 1701; and *hypatē mesōn* in all three genera will be 1512, which Ptolemy laid down without demonstration, as a fixed note | preserving the epitritie ratio with 2016. The exposition of the numbers is written out below, as follows.⁶⁴⁹

Enharmonic	Chromatic	Diatonic
1512	1512	1512
5:4	32:27	9:8
1890	1792	1701
36:35	243:224	8:7
1944	1944	1944
28:27	28:27	28:27
2016	2016	2016

Chapter 14

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<Now⁶⁵⁰ the chromatic tetrachord, as we said, was put together by him in a way contrary to his own premise (for the number 1792 makes an epimoric ratio neither with 1512 nor with 1944), while both the chromatic and the enharmonic were put together in a way contrary to the plain evidence of the senses. For we grasp the 'following' ratio of the familiar chromatic as greater than 28:27, while the 'following' ratio in enharmonic, once again, which appears much smaller than its counterparts in the other genera, he supposes to be equal to them; and further, he makes the middle ratio smaller than it, setting it in the ratio 36:35, though wherever it occurs such a thing is always unmelodic, that is, where the magnitude next to the lowest note is greater than the middle one.

⁶⁴⁹ The table that follows is found only in the Ptolemy MSS, not in Porphyry's.

⁶⁵⁰ In this chapter, as in its predecessor, no lemmata are provided, and I have again supplied the whole of Ptolemy's text to facilitate comparison. Porphyry quotes most of it verbatim and elsewhere paraphrases it closely with few significant additions.

λογικῶς κριτηρίῳ περιποιῆσαι τὴν διαβολήν, ὅτι κατὰ τοὺς ἐκτιθεμένους λόγους ὑπὸ τῶν προϊσταμένων αὐτοῦ γινομένης τῆς τοῦ κανόνος κατατομῆς οὐ διασφύζεται τὸ ἐμμελές. οἱ γὰρ πλεῖστοι τῶν τε προκειμένων καὶ τῶν τοῖς ἄλλοις σχεδὸν ἅπασι διαπεπλασμένων οὐκ ἐφαρμόζουσι τοῖς ὁμολογουμένοις ἤθεσιν. ἔοικε δὲ καὶ τὸ πλῆθος τῶν γενῶν [15] κατὰ μὲν τὸν Ἀρχύταν ἐνδεῖν τοῦ μετρίου, μὴ μόνον αὐτοῦ τὸ ἐναρμόνιον ἀλλὰ καὶ τὸ τε χρωματικὸν καὶ τὸ διατονικὸν ἐκάτερον μονοειδές ὑποθεμένου, κατὰ δὲ τὸν Ἀριστόξενον ὑπερβάλλειν μὲν ἐπὶ τοῦ χρωματικοῦ, τῶν τε τοῦ μαλακοῦ καὶ τοῦ ἡμιολίου διέσεων εἰκοστῶ καὶ τετάρτῳ μέρει τόνου διαφερουσῶν, ὥς μηδεμίαν ἀξιόλογον ταῖς αἰσθήσεσιν ἐμποιοῖν παραλλαγὴν, ἐνδεῖν δὲ ἐπὶ τοῦ διατονικοῦ, πλειόνων φαινομένων σαφῶς τῶν μελωδουμένων, ὥς ἐκ τῶν αὐτίκα ἐπιδειχθησομένων ἐξέσται σκοπεῖν. ἔτι δὲ οὐκ ὕγιως οὐδ' οὗτος οὔτε ἐπὶ τῶν πυκνῶν ἴσα ἀλλήλοις ποιεῖ τὰ ἐπόμενα δύο μεγέθη τοῦ μέσου πανταχῇ καταλαμβανομένου μείζονος, οὔτε πάλιν ἴσα τὰ πρὸς τῷ βαρυτάτῳ φθόγγῳ [20] διαστήματα τοῦ τε συντόνου διατόνου καὶ τοῦ τονιαίου χρωματικοῦ μείζονος τοῦ χρωματικοῦ συνισταμένου.

- (5) Παρὰ μὲν δὴ τὴν πρόθεσιν ὥς ἔφαμεν αὐτῶς συνεστάθη τὸ χρωματικὸν τετράχορδον, ὅτι ὁ ἀψιβ' ἀριθμὸς οὔτε πρὸς τὸν ἀφιβ' ποιεῖ λόγον ἐπιμόριον, οὔτε πρὸς τὸν αλγμδ'. παρὰ δὲ τὴν ἀπὸ τῆς αἰσθήσεως ἐνάργειαν ὁμοίως ἢ σύστασις αὐτοῦ τε καὶ τοῦ ἐναρμονίου γεγένηται. τὸν τε γὰρ ἐπόμενον λόγον τοῦ συνήθους χρωματικοῦ φησι μείζονα καταλαμβανόμενον τοῦ ἐπὶ κζ' λόγου. δέικνυται γὰρ οὗτος ἐπὶ κα'. καὶ τὴν ἐν τῷ ἐναρμονίῳ πάλιν ἐπόμενον τῶν ἐν τοῖς ἄλλοις γένεσιν ἐπομένων ἐλάττονα πολλῶ φαινόμενον κατὰ Πτολεμαῖον ἴσον ὁ αὐτὸς Ἀρχύτας ὑποτίθεται.

- (10) Πτολεμαῖος μὲν γὰρ αὐτὸν ποιεῖ ἐπὶ με' καὶ τοὺς ἐξῆς πάντας τῶν ὁμοίων μείζοντας. Ἀρχύτας δ' ἐποίησε πάντας ἴσους καὶ ἐν ἐπὶ κζ' λόγῳ.

- (15) Καὶ πρὸς τούτοις ἐλάττονα τοῦ ἐπὶ κζ' τὸν μέσον ἐν ἐπὶ λε' λόγῳ τιθέμενος ἐκμελοῦς ἄντικρυς τοῦ τοιούτου κατὰ πᾶν τετράχορδον γινομένου. διόπερ ὁ Πτολεμαῖος πάντας τοὺς μέσους μείζοντας τῶν ἐπομένων πεποίηκεν, ὥς ἐκ τῆς προκειμένης αὐτοῦ καταγραφῆς ἐστὶ φανερόν.

1 ἀρχὴ τοῦ 18' κεφαλαίου add. p κεφ. 18' ἐξήγησις εἰς τὸ παρὰ μὲν δὴ τὴν πρόθεσιν G
ἀρμονίῳ p 16 μείζοντας Wallis ἐλάττονας codd.

8 ἐναρμονίῳ]

These things, then, seem to provoke a slanderous accusation against the rational criterion, since when the division of the *kanōn* is made according to the ratios set out in his proposals, that which is melodic is not preserved. For the majority of those set out above, and of those that have been worked out by virtually everyone else, are not attuned to the characters generally agreed on. Again, the number of genera admitted by Archytas falls short of the norm, since he supposes that not only the enharmonic, but the chromatic and diatonic too, are each single in form, while those admitted by Aristoxenus are too many in the chromatic (where the dieses of the soft and of the hemiolic differ by a twenty-fourth part of a tone, which imprints no noticeable variation on the hearing), but fall short in the diatonic, where it is obvious that those that are sung are more, as we shall be able to see from things that will shortly be demonstrated. Again, he too is wrong both in respect of the *pykna*, where he makes the two 'following' magnitudes equal to one another, whereas the middle one is always grasped as being greater, and in making equal the intervals next to the lowest note in the tense diatonic and the tonic chromatic, so making the chromatic too big.> Ptol. *Harm.* 32.1–27

Now the chromatic tetrachord, as we said, was put together by him in a way contrary to his own premise, since the number 1792 makes an epimoric ratio neither with 1512 nor with 1944, and in the same way both its constitution and that of the enharmonic were contrary to the plain evidence of the senses. | For Ptolemy says that we grasp the 'following' ratio of the familiar chromatic as greater than 28:27 (he shows that it is 22:21);⁶⁵¹ while the 'following' ratio in enharmonic, which according to Ptolemy appears much smaller than its counterparts in the other genera, Archytas supposes to be equal | to them. For Ptolemy makes it 46:45, and all its counterparts greater;⁶⁵² whereas Archytas made them all equal, in the ratio 28:27.

Further, he makes the middle interval, in the ratio 36:35, smaller than the ratio 28:27, | though where this happens in any tetrachord it is always unmelodic. For this reason Ptolemy has made all the middle ratios greater than the 'following' ratios, as is clear from the diagram which he provides.⁶⁵³

⁶⁵¹ Ptolemy assigns the ratio 22:21 to the lowest ratio of the tense chromatic in I.15 (35.6–7), and in I.16 (38.2–6) he explains that this is the only form of the chromatic which is 'familiar' to people's ears.

⁶⁵² They are all worked out and presented in tables in the course of Ptolemy's I.15.

⁶⁵³ The first sentence paraphrases Ptol. *Harm.* 32.7–10, with no significant deviation from the sense; it omits Ptolemy's last clause, 'that is, where the magnitude next to the lowest note is made greater than the middle one'. The second sentence again looks forward to I.15. Most theorists' divisions are in line with the rule that the middle interval cannot be smaller than the lowest (stated also by Aristoxenus at *El. harm.* 52.8–12); so far as we know, it was broken only by Archytas and much later by Didymus (in his chromatic division; see the tables in Ptol. *Harm.* II.14).

- Ταῦτα μὲν δὴ δοκεῖ τῷ λογικῷ κριτηρίῳ περιποιῆσαι τὴν διαβολήν, ὅτι κατὰ τοὺς ἐκτιθεμένους λόγους ὑπὸ τῶν προϊσταμένων αὐτοῦ τοῦ
- (20) Ἀρχύτου γινομένης τῆς τοῦ κανόνος κατατομῆς οὐ διασώζεται τὸ ἐμμελές, ὃ προσηνές ἐστὶ τῇ αἰσθήσει. οἱ γὰρ πλεῖστοι τῶν προκειμένων λόγων καὶ τῶν τοῖς ἄλλοις Πυθαγορείοις ἅπασι σχεδὸν διαπεπλασμένων οὐκ ἐφαρμόζουσι τοῖς ὁμολογουμένοις ἤθεσιν ἐν ταῖς μελωδίαις.
- (25) ἔοικε δὲ καὶ τὸ πλῆθος τῶν γενῶν κατὰ μὲν τὸν Ἀρχύταν φησὶν ἐλλείπειν τοῦ μετρίου, μὴ μόνον αὐτοῦ τὸ ἐναρμόνιον, ἀλλὰ καὶ τὸ χρωματικὸν καὶ τὸ διατονικὸν ἐκότερον μονοειδές ὑποθεμένου. κατὰ δὲ τὸν Ἀριστόξενον ὑπερβάλλειν μὲν ἐπὶ τοῦ χρωματικοῦ τῶν τε τοῦ μαλακοῦ καὶ τοῦ ἡμιολίου διέσεων κδ' μέρει τόνου διαφερουσῶν· τὰ μὲν γὰρ ἡ' τῶν θ' διαφέρουσιν ἐνί· τοῦτο δὲ τόνου μέρος ἐστὶν κδ', ὅπερ οὐδεμίαν
- (30) αἰσθητὴν ταῖς ἀκοαῖς παραλλαγὴν ἐμποιεῖ· ἐνδεῖν δ' ἐπὶ τοῦ διατονικοῦ πλειόνων φαινομένων σαφῶς τῶν μελωδουμένων γενῶν, ὥς ἔσται σκοπεῖν εὐθέως ἀπὸ τῶν δειχθησομένων ὑπὸ τοῦ Πτολεμαίου γενῶν.

Δύο γὰρ οὗτος, ὥς εἴρηται, ποιεῖται τοῦ χρωματικοῦ, μαλακὸν τε καὶ

- (142) σύντονον, ἀντὶ τριῶν τῶν κατ' Ἀριστόξενον, καὶ τρία τοῦ διατονικοῦ, μαλακὸν τε καὶ σύντονον καὶ τὸ μεταξὺ αὐτῶν τονιαῖον διάτονον, ἀντὶ τῶν κατ' Ἀριστόξενον δύο γενῶν.
- Ἔτι δὲ καὶ οὐχ ὕγιως οὐτ' οὗτος οὐτ' ἐπὶ τῶν πυκνῶν ἀλλήλοισι ἴσα
- (5) ποιεῖ τὰ ἐπόμενα δύο μεγέθη, ζ' καὶ ζ' καὶ ἡ' καὶ ἡ' καὶ θ' καὶ θ' [τὴν δὲ λόγου χάριν ζ' καὶ ἡ' καὶ θ' καὶ ιβ'], τοῦ μέσου πανταχοῦ καταλαμβανομένου μείζονος, οὐτ' αὖ πάλιν ἴσα τὰ πρὸς τῷ βαρυτάτῳ φθόγγῳ διαστήματα τοῦ τε συντόνου διατόνου καὶ τοῦ τονιαίου χρωματικοῦ· ιβ' μὲν γὰρ ἐστὶν ἕκαστον μοιρῶν. αἶ
- (10) δὲ τὸ διάτονον μείζον ὀφείλει διάστημα ποιεῖν ἀπὸ ὑπάτης ἐπὶ παρυπάτην τοῦ χρωματικοῦ τονιαίου τοῦ ἀπὸ ὑπάτης ἐπὶ παρυπάτην.

ιε'

[33] Φέρε τοίνυν ἐπειδήπερ οὐδὲ τούτοις ὁμολογουμένως ταῖς αἰσθήσεσι διήρηται τὰ πρῶτα γένη τῶν τετραχόρδων, πειραθῶμεν αὐτοὶ κάνταυθα διασῶσαι τὸ ταῖς τῶν ἐμμελειῶν ὑποθέσει καὶ τοῖς φαινομένοις ἀκόλουθον ἐπόμενοι ταῖς πρώταις καὶ κατὰ φύσιν τῶν μερισμῶν ἐπιβολαῖς. προσλαμβάνομεν δὲ εἰς τὰς θέσεις καὶ τάξεις τῶν πηλικοτήτων [5]

lemma addidi

1 ἀντί— 2 σύντονον om. p 5-6 [τὴν δὲ λόγου χάριν ζ' καὶ ἡ' καὶ θ' καὶ ιβ'] delevi 10 ὑπάτης ἐπὶ παρυπάτην Wallis ὑπάτων παρυπάτης codd. 11 τέλος τοῦ ιδ' κεφαλαίου add. p 12 ἀρχὴ τοῦ ιε' κεφαλαίου add. p περὶ τῆς κατὰ τὸ εὐλογον καὶ τὸ φαινόμενον τῶν τε χορδῶν γενῶν διαιρέσεων add. V¹⁸⁷

in lemma: 33.3 post ταῖς add. τε codd. post τοῖς add. τό codd. 4 καὶ om. codd.

These things, then, seem to provoke a slanderous accusation against the rational criterion, since when the division of the *kanōn* is made | according to the ratios set out in Archytas' proposals, that which is melodic and agreeable to perception is not preserved. For most of the ratios set out above, and those that have been worked out by virtually all the other Pythagoreans, are not attuned, in melodies, to the characters generally agreed on. The number of genera admitted by Archytas, says Ptolemy, also falls short | of the norm, since he supposes that not only the enharmonic but the chromatic and diatonic too are each single in form; while those admitted by Aristoxenus are too many in the chromatic (where the dieses of the soft and of the hemiolic differ by a twenty-fourth part of a tone – for 8 and 9 differ by 1, and this is a twenty-fourth part of a tone⁶⁵⁴ – which imprints no | noticeable variation on the hearing), but fall short in the diatonic, where it is obvious that the genera that are sung are more, as we shall be able to see shortly from the genera that will be demonstrated by Ptolemy. For Ptolemy, as has been said, makes two forms of chromatic, the soft and the tense, instead of the three posited by Aristoxenus; and he makes three forms of the diatonic, the soft, the tense, and between them the tonic diatonic, instead of the two genera posited by Aristoxenus.

[142D]

Again, he too [Aristoxenus] is wrong in respect of the *pyknon*, where he makes the two 'following' | magnitudes equal to one another, 6 and 6, 8 and 8, 9 and 9, whereas the middle one is always grasped as being greater, and again because he makes equal the intervals next to the lowest note in the tense diatonic; for each is of 12 units, and | the diatonic ought always to make a greater interval between *hypatē* and *parhypatē* than that between *hypatē* and *parhypatē* in tonic chromatic.

Chapter 15

Since⁶⁵⁵, then, not even these people have divided the primary genera of the tetrachords in a way that agrees with perception, let us ourselves try, here as well, to preserve what is consistent both with our postulates concerning melodic relations and with the perceptual appearances, in accordance with those conceptions of the divisions that are primary and natural.

To find the positions and orderings of the quantities, we adopt on the basis of our primary postulate and of reason the principle, common to all

⁶⁵⁴ According to Ptolemy's account in I.12, where the tone is represented as containing 24 units, the intervals in the *pyknon* of Aristoxenus' soft chromatic are of 8 units each, and those of the hemiolic chromatic of 9.

⁶⁵⁵ This long chapter includes several lemmata, but they do not add up to the whole of Ptolemy's text; other parts of it are inserted as quotations within Porphyry's discussion.

παρά μὲν τῆς ἀρχῆθεν ὑποθέσεως καὶ τοῦ λόγου κοινὸν πάντων τῶν γενῶν τὸ καὶ ἐπὶ τῶν τετραχόρδων τοὺς ἐφεξῆς φθόγγους ἀεὶ πρὸς ἀλλήλους ἐπιμορίους ποιεῖν λόγους τοὺς μέχρι τῶν εἰς δύο παρίσους ἢ τρεῖς παρίσους τομῶν, αἷς ἐπεραίνοντο καὶ αἱ τῶν πρώτων συμφωνιῶν ὑπεροχαὶ καὶ μέχρι τῆς τριάδος φθάνουσαι κάκει διὰ τὸ συντελεστικόν [10] αὐτῆς πασῶν τῶν διαστάσεων. ἀπὸ γὰρ τοῦ διὰ πασῶν ὁμοφώνου καὶ τοῦ διπλασίου λόγου, καθ' ὃν ἡ ὑπεροχὴ τῶν ἄκρων ἴση συνειστῆκει τῷ ὑπερεχομένῳ, ἐπὶ μὲν τὴν ἀπὸ τοῦ ἴσου καθαίρεισιν ὃ τε ἡμιόλιος ἐλαμβάνετο λόγος τῆς διὰ πέντε συμφωνίας, καθ' ὃν ἡ ὑπεροχὴ τῶν ἄκρων ἡμισυ περιέχει μέρος τοῦ ὑπερεχομένου, καὶ ὁ ἐπίτριτος τῆς διὰ [15] τεσσάρων συμφωνίας, καθ' ὃν ἡ ὑπεροχὴ τῶν ἄκρων τρίτον περιέχει μέρος τοῦ ὑπερεχομένου, ἐπὶ δὲ τὴν ἀπὸ τῆς ἰσότητος αὔξησιν ὃ τε triπλασιος λόγος ἐλαμβάνετο τῆς διὰ πασῶν καὶ διὰ πέντε συμφωνίας, καθ' ὃν ἡ ὑπεροχὴ τῶν ἄκρων δύο ποιεῖ τοὺς ὑπερεχομένους ἐν ἀντιθέσει τοῦ ἡμίσεος μέρους, καὶ ὁ τετραπλάσιος τοῦ δις διὰ πασῶν ὁμοφώνου, καθ' [20] ὃν ἡ ὑπεροχὴ τῶν ἄκρων τρεῖς ποιεῖ τοὺς ὑπερεχομένους ἐν ἀντιθέσει πάλιν τοῦ τρίτου μέρους.

- (14) Ἀποδείξας οὖν τὰ πρώτα γένη τῶν τετραχόρδων, ἃ ἀπὸ τ' Ἀριστοξένου καὶ Ἀρχύτου διήρηται οὐχ ὁμολόγως ταῖς τῶν μουσικωτέρων αἰσθήσεσιν καὶ παρὰ τὰς θέσεις καὶ τάξεις τῶν διαστημάτων αὐτοῖς ὑποκειμένων καὶ ὅσα περὶ αὐτῶν εἴρηκεν, πειρᾶται κάνταῦθα διασῶσαι καὶ τὸ ἀκόλουθον ταῖς τῶν ἐμμελειῶν ὑποθέσεσιν ἔν τε τῇ θέσει καὶ τῇ τάξει τῶν ἐπιμορίων λόγων καὶ τὸ πρὸς τὰ φαινόμενα τῶν ἡθῶν ἐν ταῖς μελω-
- (20) δαῖς ὁμολογούμενον ἀκολουθῶς ταῖς πρώταις καὶ κατὰ φύσιν τῶν μερισμῶν ἐπιβολαῖς, αἷς κέχρηται πρὸς τὸν ὑγιέστερον τῶν λόγων ἐπὶ τῶν συμφωνιῶν διορισμόν. προσλαμβάνει δ' εἰς θέσεις καὶ τάξεις τῶν πηλικοτήτων, τουτέστι τῶν φθόγγων, παρὰ μὲν τῆς ἀρχῆθεν ὑποθέσεως τῆς κατὰ τὰς συμφωνίας αὐτῶν προεκτεθειμένης καὶ τοῦ λόγου, κοινὸν πάν-
- (25) των τῶν γενῶν, τὸ καὶ ἐπὶ τῶν τετραχόρδων τοὺς ἐφεξῆς φθόγγους ἀεὶ πρὸς ἀλλήλους ἐπιμορίους ποιεῖν λόγους τοὺς μέχρι τῶν εἰς δύο παρίσους ἢ τρεῖς παρίσους τομῶν· ἐπεὶ μὴ δυνατὸν εἰς ἴσα τέμνειν ἐπιμόριον
- (I43) λόγον ἢ διπλάσιον ἀλλ' εἰς πάρισα, ὡς τὸ διὰ πασῶν ἐν διπλασίονι λόγῳ τυγχάνον εἰς πάρισα διήρηται, τὸ δὲ διὰ πέντε καὶ διὰ τεσσάρων κατὰ τὸν ἡμιόλιον λόγον καὶ τὸν ἐπίτριτον, τριῶν ἐνταῦθα γενομένων ὑπερο-

14 ἀποδείξας Alexanderson ἀποδείξει codd.

18 θέσει e Ptol. αἰσθήσει codd.

24 αὐτῶ] αὐτῶν

the genera, that in the tetrachords too, the successive notes always make those epimoric ratios in relation to one another which amount to divisions into two or three that are nearly equal. By these divisions the differences in the first concords were also found to be bounded, and they go only up to the number 3 there too, since that completes all the intervals. For beginning from the octave homophone and the double ratio, in which the difference between the extremes is equal to the one which is exceeded, we took for its reduction from equality⁶⁵⁶ the hemiolic ratio of the concord of a fifth, in which the difference between the extremes contains a half of that which is exceeded, and the epitrititic ratio of the concord of a fourth, in which the difference between the extremes contains a third part of that which is exceeded; and for its augmentation from equality we took the triple ratio of the concord of an octave and a fifth, in which the difference between the extremes makes two of that which is exceeded, antithetically to the half, and the quadruple ratio of the double octave homophone, in which the difference between the extremes makes three of that which is exceeded, antithetically, once again, to the third part. Ptol. *Harm.* 33.1–22

Having shown, then, that the primary genera of the tetrachords, as they were divided by Aristoxenus | and Archytas, are not in agreement with the perceptions of musically superior people, and conflict with the positions and orderings of the intervals assigned to them and with what Ptolemy has said about them, he tries, here as well, to preserve both what is consistent with the postulates concerning melodic relations in the position and ordering of epimoric ratios, and that which agrees with the impressions of the characters that are perceived in melodies, | in accordance with the conceptions of the divisions that are primary and natural, on which he has already drawn in the case of the concords, in the service of a sounder definition of their ratios.

To find the positions and orderings of the quantities, that is, of the notes, he adopts, on the basis of the primary postulate that he has already set out concerning the concords, and on the basis of reason, the thesis, common to all | the genera, that in the tetrachords too, the successive notes always make those epimoric ratios in relation to one another which amount to divisions into two or three that are nearly equal; for it is not possible to divide an epimoric ratio or the double ratio into equal parts, but only into near-equals, as the octave, which is double ratio, is divided into near-equals, the fifth and the fourth, in hemiolic and epitrititic ratio respectively, so that the number of excesses arising is three. For the original [143D]

⁶⁵⁶ I must record here an important correction to my translation of Ptolemy in Barker (1989), where the words at *Harm.* 33.13 and 33.17 which I now render as 'from equality' were translated, wrongly, as 'by equals'.

- χῶν. ἦν γάρ τὸ πρῶτον τὸ ὁμόφωνον ἐν καὶ ἔν, εἴτ' ἀπὸ τῆς ἰσότητος
- (5) παραυξήσεως γενομένης τῷ ἑτέρῳ μονάδος ἐγένετο παρ' ἰσότητα λόγου ὁ τοῦ διὰ πασῶν ἐν διπλάσιῳ λόγῳ τῶν δύο πρὸς τὸ ἐν, μετὰ δὲ τὸν διπλάσιον λόγον προσθήκη μονάδος ἦν γενόμενος ὁ ἡμιόλιος λόγος ὁ τῶν τρία πρὸς τὰ δύο, ὁμοίως δὲ τοῦ αὐτοῦ γενομένου ἐπὶ τοῦ ἡμιολίου γέγονεν ἐπίτριτος, ὥσθ' ὑπεροχὰς τρεῖς εἶναι· καὶ αἰε παραυξήσεως γινο-
- (10) μένης, τούτέστι προστεθείσης ἐκατέρῳ τῶν ὄρων μονάδος, ἐλάττων ὁ λόγος ἐστὶν ἐν ὑπεροχῇ μονάδος ἀμφοτέρων αὐτῶν ὄντων, ἥτις ἀπὸ τῆς ἰσότητος μειουμένου τοῦ λόγου κατὰ μὲν τὸ διὰ πασῶν καὶ τὸν διπλάσιον λόγον ἴση γίνεται τῷ ὑπερεχομένῳ, κατὰ δὲ τὸ διὰ πέντε καὶ τὸν ἡμιόλιον λόγον ἡμίσεια τοῦ ὑπερεχομένου, κατὰ δὲ τὸ διὰ τεσσάρων καὶ τὸν
- (15) ἐπίτριτον λόγον τρίτον μέρος τοῦ ὑπερεχομένου. πάλιν δ' αὖ ἀπὸ τῆς ἰσότητος αὐξομένου τοῦ λόγου μονάδος προστιθεμένης τῷ μείζονι τῶν ὄρων ὁ τριπλάσιος λόγος ἐλαμβάνετο τῆς διὰ πασῶν καὶ διὰ πέντε συμφωνίας, καθ' ὃν ἡ ὑπεροχὴ τῶν ἄκρων δις ποιεῖ τοὺς ὑπερεχομένους ἐν ἀντιθέσει τοῦ ἡμίσιου μέρους· καὶ ὁ τετραπλάσιος τοῦ δις διὰ πασῶν
- (20) ὁμοφώνου, καθ' ὃν ἡ ὑπεροχὴ τῶν ἄκρων τρεῖς ποιεῖ τοὺς ὑπερεχομένους ἐν ἀντιθέσει πάλιν τοῦ τρίτου μέρους.

- Παρὰ δὲ τῆς ὁμολογουμένης αἰσθήσεως κοινὸν μὲν ὁμοίως πάντων τῶν ὁμογενῶν λαμβάνει τὸ τὰ γ' ἐπόμενα τῶν τριῶν διαστημάτων ἐλάττονα συνίστασθαι τῶν λοιπῶν ἐκατέρου, ἴδια δὲ τῶν μὲν τὸ πυκνὸν
- (25) ἐχόντων, ἃ ἐστὶν ἐναρμονίων καὶ χρωματικῶν μαλακῶν τε καὶ συντόνων, τὸ τὰ πρὸς τῷ βαρυτάτῳ δύο συναμφότερα ἐλάττονα γίνεσθαι τοῦ πρὸς τῷ ὀξυτάτῳ, τῶν δ' ἀπύκνων τὸ μηδὲν τῶν μεγεθῶν μείζον καθίστασθαι τῶν λοιπῶν δύο συναμφοτέρων· εἴρηται δ' ἄπυκνα τὰ διατονικὰ διὰ τὸ πολὺ ἀπ' ἀλλήλων αὐτῶν εἶναι τὰ διαστήματα.
- (30) Τούτων οὖν ὑποκειμένων διαιρεῖ πρῶτα τὸν ἐπίτριτον λόγον τῆς διὰ τεσσάρων συμφωνίας, ὁσάκις ἔνεστιν, εἰς ἐπιμορίους λόγους δύο· τρεῖς

homophone was 1 and 1; then, when – starting from equality – | a unit was added to one of them, there arose, along with equality of ratio, the ratio of the octave, in the double ratio of 2:1; after the double ratio, by the addition of a unit, there arose the hemiolic ratio of 3:2; and similarly, by the same process, there arose the epitritit ratio over and above the hemiolic, so that there are three excesses. And by the process of increase, | that is, by the addition of a unit to one of the two terms while the excess of one over the other is a unit, the ratio always becomes smaller; so that when the ratio is reduced from equality, the excess in the case of the octave and the double ratio is equal to that which is exceeded, in that of the fifth and the hemiolic ratio it is half of that which is exceeded, and in that of the fourth and the | epitritit ratio it is a third part of that which is exceeded.⁶⁵⁷ And again, when the ratio is increased from equality by the addition of a unit to the greater term, the triple ratio of the concord of an octave and a fifth is constructed, in which the excess of one extreme over the other makes two of that which is exceeded, antithetically to the half; and there is constructed the quadruple ratio of the homophone of the double | octave, in which the excess of one term over the other makes three of that which is exceeded, again antithetically to the third part.⁶⁵⁸

On the basis of agreed perception he adopts, similarly, as common to all the genera, the thesis that of the three intervals, the ‘following’ ones are smaller than each of the remaining ones; as peculiar to the genera that | have a *pyknon*, which are those of the enharmonic and the soft and tense chromatics, the thesis that the two magnitudes next to the lowest note are together less than the one next to the highest note; and as peculiar to the *apykna* the thesis that none of the magnitudes is greater than the remaining two together. (The diatonics are called *apykna* because the intervals are at a large distance from one another.)⁶⁵⁹

| With these principles laid down, he first divides the epitritit ratio of the concord of the fourth, as many times as possible, into two epimoric

⁶⁵⁷ Ptolemy does not say, as Porphyry does, that the process of reducing the ratios from equality is achieved by adding a unit to each of the terms, or that the process of increasing the ratio from equality is achieved by adding a unit to one (the larger) of the terms. Of course Porphyry is right about this (with the qualification that the ‘reduction’ of the ratios by this method must begin from the octave ratio, 2:1, not from the ratio of equality, 1:1, as the process of increase does); but it is not clear that it adds anything useful to our understanding of Ptolemy’s procedure.

⁶⁵⁸ Porphyry’s treatment of the passage quoted in the opening lemma ends here.

⁶⁵⁹ ‘The intervals’ here refers to the two lowest intervals in the tetrachord. It would be more accurate to say that the notes bounding these intervals are at a large distance from one another (by comparison with those bounding a *pyknon*); but the intended sense is clear enough. This paragraph is quoted from Ptol. *Harm.* 33.22–7. Porphyry’s only substantial changes are the addition of ‘which are those . . . tense chromatics’ at 143.25–6, and the closing parenthesis at 143.28–9.

δὲ γίνεται μόνως πάλιν καὶ τὸ τοιοῦτο προσλαμβανομένων τῶν ὑπ' αὐτὸν τριῶν ἐφεξῆς ἐπιμορίων τοῦ τ' ἐπὶ δ' καὶ τοῦ ἐπὶ ε' καὶ τοῦ ἐπὶ ζ'. συμπληροῖ γὰρ τὸν ἐπίτριτον λόγον τῷ μὲν ἐπὶ δ' προστεθείς ὁ ἐπὶ ιε', τῷ δ' ἐπὶ ε' ὁ ἐπὶ θ', τῷ δ' ἐπὶ ζ' ὁ ἐπὶ ζ'. καὶ μετὰ τούτους δύο μόνους

- (144) ἄλλοις ἐπιμορίοις οὐκ ἂν εὖροι τις συντεθειμένον τὸν ἐπίτριτον λόγον. γινέσθω δ' ἡ σύνθεσις δύο ληφθέντων ἐπιμορίων. οἷον μετὰ τὸν ἐπίτριτον ἐφεξῆς αὐτοῦ ἐπιμόριοι ἦσαν ὁ ἐπὶ δ' καὶ ὁ ἐπὶ ε' καὶ ὁ ἐπὶ ζ'. ἐπειδὴ μὲν ὁ ἐπὶ γ' λόγος διαιρεῖται εἰς ἐπὶ δ' καὶ ἐπὶ ιε', καὶ ἐπὶ ε' καὶ ἐπὶ θ', καὶ ἐπὶ ζ' καὶ ἐπὶ ζ'. ἐπιτετάρτου πυθμὴν ὁ ε' τοῦ δ'· ἔχει γὰρ ὁ ε' τὸν δ' καὶ τὸ τέταρτον αὐτοῦ α'· ἐπιπέμπτου δὲ πυθμὴν ὁ ζ' τοῦ ε'. ἐπὶ ζ' δὲ πυθμὴν ὁ ζ' τοῦ ζ'. ὁ μὲν γὰρ ἔχει τὸν ἐλάσσονα καὶ τὸ <πέμπτων> αὐτοῦ μέρος, ὁ δὲ τὸν ζ' καὶ τὸ ἕκτον. οὗτοι τοίνυν ἄλλοις ἐπιμορίοις συντεθέντες ἀποτελοῦσι τὸν ἐπίτριτον· ὁ μὲν ἐπὶ δ' τῷ ἐπὶ ιε' ὁ δ' ἐπὶ ε' τῷ ἐπὶ θ' ὁ δ' ἐπὶ ζ' τῷ ἐπὶ ζ'. ἔστι δ' ἐπὶ ιε' μὲν πυθμὴν ὁ ις' τοῦ ιε'· ἔχει γὰρ αὐτὸν καὶ τὸ ιε'· ἐπὶ θ' δὲ πυθμὴν ὁ ι' τοῦ θ', ἔχων αὐτὸν τὸν θ' καὶ τὸ ἕννατον· ἐπὶ ζ' δὲ <πυθμὴν> ὁ η' τοῦ ζ'· ἔχει γὰρ τὸν ζ' καὶ τὸ ζ' αὐτοῦ. συνθῶμεν οὖν αὐτοὺς προτάξαντες τὸν μὲν ἐπὶ δ' τοῦ ἐπὶ ιε', τὸν δ' ἐπὶ ε' τοῦ ἐπὶ θ', τὸν δ' ἐπὶ ζ' τοῦ ἐπὶ ζ'. ἐπεὶ τοίνυν τοῦ ἐπὶ ιε' πυθμένος ὅροι ἐν ἀριθμοῖς ις' ιε', δεῖ τοῦ ις'

3 ἐπειδή] ἐπὶ δ' p 7 <πέμπτων> add. Alexanderson
g <πυθμὴν> add. Düring

12 ἐπὶ ζ' δὲ V¹⁸⁷ ἐπὶ ι' δὲ et lacuna magna

ratios; such a thing, once again, occurs only three times, when we adopt in addition the three epimoric ratios in succession below it, the ratios 5:4, 6:5 and 7:6. For the ratio 16:15 added to the ratio 5:4 fills out the epitrittic ratio, | as does the ratio 10:9 added to the ratio 6:5, and the ratio 8:7 added to the ratio 7:6. And after these one cannot find the epitrittic ratio put together from just two other epimorics.⁶⁶⁰ [144D]

Let two of the specified epimorics be combined, given that the epimoric ratios in succession after the epitrittic are 5:4, 6:5 and 7:6. Since the ratio 4:3 is divisible into 5:4 and 16:15, 6:5 and | 10:9, and 7:6 and 8:7, when these ratios are put together with other epimorics they produce the epitrittic – 5:4 with 16:15, 6:5 with 10:9, and 7:6 with 8:7. (The foundation of the quarter-in-addition ratio is 5 of the 4,⁶⁶¹ for 5 contains 4 and its quarter, 1; the foundation of the fifth-in-addition ratio is 6 of the 5, and the foundation of the sixth-in-addition ratio is 7 of the 6, for the former contains the smaller term and a fifth part of it, and the latter contains 6 and a sixth part of it. | The foundation of the fifteenth-in-addition ratio is 16 of the 15, for it contains the latter and its fifteenth part; the foundation of the ninth-in-addition ratio is 10 of the 9, since it contains 9 and a ninth part of it; and the foundation of the seventh-in-addition ratio is 8 of the 7, for it contains 7 and a seventh of it.)⁶⁶² So let us put them together, placing the ratio 5:4 before 16:15, 6:5 before 10:9, and 7:6 before 8:7.⁶⁶³ | Since, then, the terms of the foundational fifteenth-in-addition ratio are in the numbers

⁶⁶⁰ Apart from the substitution of 'he . . . divides' for 'we . . . divide', this paragraph is a word-for-word quotation of Ptol. *Harm.* 33.27–34.4. It may well have originated as a lemma, since (a) it contains no additional comments, (b) Porphyry discusses it in the passage that follows, and (c) the next lemma picks up at *Harm.* 34.5.

⁶⁶¹ In parts of this paragraph, and occasionally but rarely elsewhere, I represent Greek expressions such as *epitetartos* (for the ratio 5:4), *epipemptos* (6:5), and their abbreviated semi-numerical equivalents, in the form 'quarter-in-addition', 'fifth-in-addition' and so on. This is to convey the fact that the standard Greek designation for the ratio we call 5:4, for instance, does not refer specifically to the terms 5 and 4. It means that one of the numbers is equal to the other plus a quarter of the latter, and therefore embraces all ratios that have that property, e.g. 10:8 or 30:24 as well as 5:4 itself. Hence when Porphyry says that the foundation (*pythmēn*) of this ratio is 5 of the 4 (i.e. that 5 is the smallest number that contains some other number plus its quarter, and that the number in question is 4), he is not saying something quite as obvious as we would be, if we said that 5:4, in its lowest terms, is 5 in relation to 4.

⁶⁶² In Porphyry's text this parenthesis appears in two parts. The first, dealing with the ratios 5:4, 6:5 and 7:6, is placed part way through the previous sentence (at 144.5–8, before the words 'when these ratios'). The second, dealing with the other ratios, comes after the end of that sentence, at 144.10–13. I have put them together here to make the sentence easier to follow.

⁶⁶³ Which ratio in each pair will be placed first makes no difference to the arithmetic involved in the subsequent discussion. Later in the chapter, however, placing one ratio before the other corresponds to placing the interval whose ratio it is at the top of the tetrachord; and this does make a difference, since while the chosen ratio will remain intact, the other will be subdivided into the two smaller ratios belonging to the two lower intervals.

- λαβεῖν ἐπιτέταρτον, ἵνα γένηται ἡ σύνθεσις· ἔσται δὲ ὁ κ'· ἔχει γὰρ τὸν ις' καὶ τὸ δ' τῶν ις', τὰ δ'· ἔσονται τοίνυν δύο λόγοι ἐν ὅροις τοῖς κ' ις' ιε'· ἐπὶ δ' μὲν ὁ κ' τοῦ ις'· ἐπὶ ιε' δ' ὁ ἐπόμενος ὁ ις' ιε', ὧν οἱ ἄκροι ὁ κ' καὶ ὁ ιε' ἐπὶ γ'· σύγκειται ἄρα ὁ ἐπὶ γ' ἐκ τοῦ ἐπὶ δ' καὶ
- (20) ἐπὶ ιε', καὶ δῆλον, ὅτι διαιρεῖται εἰς αὐτούς. πάλιν εἰλήφθω ἐπὶ θ' ὁ δέκα τοῦ θ' καὶ συντιθέσθω τῷ ἐπὶ ε' ἡγουμένῳ αὐτοῦ· ἐπὶ ε' δ' ἂν εἴη τῶν ι' ὁ ιβ', ἔχων τὸν ι' καὶ τὸ ε' αὐτοῦ τὰ β'· ἔσονται οὖν οἱ ὅροι ιβ' καὶ ι' καὶ θ' λόγους περιέχοντες δύο, ἐπὶ ε' τε καὶ ἐπὶ θ', ὧν πάλιν οἱ ἄκροι ἐν ἐπὶ γ'· ὁ γὰρ ιβ' τοῦ θ' ἐπίτριτος. ὥστε πάλιν συνετέθη ὁ
- (25) ἐπὶ γ' ἐκ δύο ἐπιμορίων λόγων ἐλαττόνων αὐτοῦ τοῦ τ' ἐπὶ ε' καὶ τοῦ ἐπὶ θ' καὶ δῆλον, ὅτι διαιρεῖται εἰς αὐτούς.

- Πάλιν εἰλήφθω ἐπὶ ζ' ὁ κδ' καὶ συντιθέσθω λόγῳ ἡγουμένῳ αὐτοῦ τῷ ἐπὶ ζ'· ἐπὶ ζ' δὲ τῶν κδ' ὁ κη'· ἔσονται οὖν δύο λόγοι συγκείμενοι ἐν ὅροις ἀριθμητικοῖς τοῖς κη' κδ' κα', ἐπὶ ζ' καὶ ἐπὶ ζ', ὧν πάλιν οἱ
- (30) ἄκροι ἐπὶ γ', τουτέστιν ὁ κη' τοῦ κα'. νῦν μὲν οὖν προτάξαντες τοὺς ἐφεξῆς τοῦ ἐπὶ γ', τὸν ἐπὶ δ' λέγω καὶ τὸν ἐπὶ ε' καὶ τὸν ἐπὶ ζ', ὑποτάξαντες τοὺς ἄλλους, συνεθήκαμεν τὸν ἐπὶ γ', τρεῖς τοῦτο ποιήσαντες ἐκ τῆς ἐφεξῆς αὐτοῦ τριῶν ἐπιμορίων. κἂν προτάξωμεν δὲ τὸν ἐπὶ ιε' ἢ τὸν ἐπὶ θ' ἢ τὸν ἐπὶ ζ', ὑποτάξωμεν δ' ἐκάστῳ τὸν σύμμετρον εἰς σύνθεσιν τοῦ ἐπὶ γ', πάλιν οἱ ἄκροι ἀποτελοῦσιν ἐπίτριτον.
- (35) Αἱ μὲν οὖν εἰς δύο τομαὶ τοῦ ἐπιτρίτου καὶ εἰς τοὺς μετ' αὐτὸν ἐλάττονας αὐτοῦ ἐπιμορίους γινόμεναι τοιαῦται, ἐξ ὧν καὶ αἱ συνθέσεις. ἐξῆς δὲ τούτοις ὁ Πτολεμαῖος ἀποδείξει βουλόμενος καὶ τὰς εἰς τρεῖς λόγους τομάς τοῦ ἐπιτρίτου· πρῶτον ἐπὶ τῶν τὸ πυκνὸν ἔχόντων τετραχόρδων
- (5) ἐπάγει ταῦτα.

Ἐπὶ μέντοι τῶν τὸ πυκνὸν περιεχόντων γενῶν, ἐπειδὴ μείζους [34.5] εἰσὶν ἐν αὐτοῖς οἱ ἡγούμενοι λόγοι συναμφοτέρων τῶν λοιπῶν, τοὺς μὲν μείζοντας λόγους τῶν ἐκκειμένων συζυγιῶν, τουτέστι τὸν τε ἐπὶ δ' καὶ τὸν ἐπὶ ε' καὶ τὸν ἐπὶ ζ', ἐφήρμοσαν τοῖς ἡγουμένοις αὐτῶν λόγοις τοὺς δὲ λοιπούς καὶ ἐλάττονας, τουτέστι τὸν τε ἐπὶ ιε' καὶ τὸν ἐπὶ θ' καὶ τὸν ἐπὶ ζ', τοῖς συναμφοτέροις τῶν λοιπῶν. γίνεται δὲ καὶ ἡ τούτων ἐκάστου διαίρεσις κατὰ τοὺς ἐπομένους δύο λόγους λαμβανόμενων αὐτοῦ τῶν εἰς τρία τομῶν διὰ τὸ τοὺς τρεῖς λόγους ἤδη τοῦ τετραχόρδου τούντεῦθεν ἀποτελεῖσθαι, τῶν μὲν ὑπεροχῶν τηρουμένων ἴσων, τῶν δὲ λόγων παρίσων, ἐπεὶ μὴ δυνατόν ἴσων. τοὺς μὲν γὰρ πρῶτους

21 ἐπὶ ε'] ἐπὶ ιε' p

22 τὸ ε' Alexanderson τὸν ε' codd.

32 τρεῖς Alexanderson πρὶν codd.

35 ἐπιτελοῦσιν p

1 αἱ] εἰ p

16 and 15, we must find the number which is 16 with a quarter <of 16> in addition, so that the combination can be made; and this will be 20, for it contains 16 and a quarter of 16, that is, 4. Thus there will be two ratios, whose terms are 20, 16 and 15. 20 is in the ratio 5:4 to 16; 16 stands to 15 in the 'following' ratio of 16:15; and the extreme terms, 20 and 15, are in the ratio 4:3. Thus the ratio 4:3 is put together from 5:4 and | 16:15, and it is obviously divisible into them. Again, let us take 10, in the ratio 10:9 with 9, and let it be put together with its 'leading' ratio, 6:5. The number related to 10 in the ratio 6:5 will be 12, which contains 10 and a fifth of it, that is, 2. Then the terms will be 12, 10 and 9, bounding two ratios, 6:5 and 10:9, and their extremes are again in the ratio 4:3, since 12 is the epitritus of 9. Thus once again the ratio 4:3 has been put together | from two epimoric ratios smaller than itself, 6:5 and 10:9, and it is obviously divisible into them.

Again, let us take 24:21, in the ratio 8:7, and let it be put together with its 'leading' ratio, 7:6. The number related to 24 in the ratio 7:6 is 28. Thus there will be two ratios, 7:6 and 8:7, put together in the numerical terms 28, 24, 21, whose | extremes, that is, 28 and 21, are again in the ratio 4:3. Now therefore, having placed the ratios successive to 4:3 in front (I mean the ratios 5:4, 6:5 and 7:6), and the others after them, we have put together the ratio 4:3, doing so three times from the three epimorics that succeed it. And if we place the ratio 16:15 or 10:9 or 8:7 in front, and place after each of them the ratio appropriate for composing | the ratio 4:3, once again the extremes will produce the epitritus.

Such, then, are the divisions of the epitritus into two, and into the epimorics that are smaller than it and come next after it. Since Ptolemy wants, after this, to demonstrate also the divisions of the epitritus into three, first in the cases of the tetrachords that contain a *pyknon*, | he continues as follows. [145D]

Now in the genera that contain the *pyknon*, since in them the 'leading' ratios are greater than the remaining ones together, they fitted the greater ratios in the pairs set out – that is, the ratios 5:4, 6:5 and 7:6 – to their 'leading' ratios, and the remaining, smaller ones – that is, the ratios 16:15, 10:9 and 8:7 – to the remaining ones taken together. The division of each of these into the two 'following' ratios is achieved when it is divided into three (because by these means the three ratios of the tetrachord are at once produced), the differences being kept equal and the ratios nearly equal, since it is not possible for them to be equal. For if we take the first numbers making the fifteenth-in-addition ratio, I mean 15 and 16, and triple them, we shall get

ποιῶντας ἀριθμούς τὸν ἐπὶ ιε', λέγω δὲ τὸν ιε' καὶ τὸν ις', τριπλασιά- [15]
 σαντες ἔξομεν τὸν με' καὶ τὸν μη', μέσους τε αὐτῶν ἐν ἴσας ὑπεροχαῖς
 τὸν μς' καὶ τὸν μζ'. τοῦ δὴ μζ' μὴ ποιῶντος πρὸς ἀμφοτέρους τοὺς
 ἄκρους ἐπιμόριον λόγον, μόνου δὲ τοῦ μς' πρὸς μὲν τὸν μη' τὸν ἐπὶ κγ',
 πρὸς δὲ τὸν με' τὸν ἐπὶ μέ', ὁ μὲν μείζων καὶ ἐπὶ κγ' διὰ τὰς ἐξαρχῆς
 ὑποθέσεις συναφθῆσεται τῷ ἐπὶ δ', ὁ δὲ λοιπὸς καὶ ἐπὶ με' τὸν ἐπόμε- [20]
 νον συμπληρώσει λόγον. ἄλλιν τοὺς πρώτους ποιῶντας ἀριθμούς τὸν
 ἐπὶ θ', τουτέστι τὸν θ' καὶ τὸν ι' τριπλασιάσαντες ἔξομεν τὸν κζ' καὶ
 τὸν λ', μέσους τε αὐτῶν ἐν ἴσας ὑπεροχαῖς τὸν κη' καὶ τὸν κθ'. ἀλλ'
 ὁ μὲν κθ' πρὸς ἀμφοτέρους τοὺς ἄκρους οὐ ποιῇ λόγον ἐπιμόριον, ὁ
 δὲ κη' πρὸς μὲν τὸν λ' τὸν ἐπὶ ιδ', πρὸς δὲ τὸν κζ' τὸν ἐπὶ κζ', ὥστε [25]
 κἀνταῦθα συνάπτεσθαι μὲν τῷ ἐπὶ ε' τὸν ἐπὶ ιδ', ὑπολείπεσθαι δὲ κατὰ
 τὸν ἐπόμενον τόπον τὸν ἐπὶ κζ'. ὁμοίως δὲ τοὺς ποιῶντας τὸν ἐπὶ ζ'
 λόγον πρώτους ἀριθμούς, τὸν τε ζ' καὶ τὸν η', τριπλασιάσαντες ἔξομεν
 τὸν κά' καὶ τὸν κδ', μέσους τε αὐτῶν ἐν ἴσας ὑπεροχαῖς τὸν κβ' καὶ
 τὸν κγ', οὐ μὴ ποιῶντος πρὸς ἀμφοτέρους τοὺς ἄκρους ἐπιμόριον λόγον, [30]
 ἀλλὰ μόνου τοῦ κβ' πρὸς μὲν τὸν κδ' ἐπὶ ια', πρὸς δὲ τὸν κά' ἐπὶ κά',
 συναφθῆσεται μὲν κἀνταῦθα τῷ ἐπὶ ς' ὁ ἐπὶ ια', ὁ δὲ ἐπὶ κά' τὸν ἐπόμε-
 νον ἐφέξει τόπον. κάπειδὴ μαλακώτατον μὲν ἐστὶ πάντων τῶν γενῶν
 τὸ ἐναρμόνιον, ὁδὸς δὲ τις ὥσπερ ἐπὶ τὸ συντονώτερον ἀπ' αὐτοῦ κατὰ
 παραύξησιν διὰ πρώτου τοῦ μαλακωτέρου χρώματος, ἔπειτα τοῦ συντο- [35]
 νωτέρου πρὸς τὰ ἐφεξῆς τῶν ἀπύκνων καὶ διατονικῶν μαλακώτερα
 δὲ φαίνεται καθόλου τὰ μείζονα τὸν ἡγούμενον ἔχοντα λόγον καὶ συν-
 τονώτερα τὰ ἐλάττωνα. τὸ μὲν συντιθέμενον τετράχορδον ἐκ τοῦ ἐπὶ
 δ' καὶ ἐπὶ κγ' καὶ ἐπὶ με' προσήψαμεν τῷ ἐναρμονίῳ γένει, τὸ δὲ συν-
 τιθέμενον ἐκ τοῦ ἐπὶ ε' καὶ ἐπὶ ιδ' καὶ ἐπὶ κζ' τῷ μαλακωτέρῳ τῶν χρω- [5]
 ματικῶν, τὸ δὲ συντιθέμενον ἐκ τοῦ ἐπὶ ς' καὶ ἐπὶ ια' καὶ ἐπὶ κά' τῷ
 συντονωτέρῳ τῶν χρωματικῶν. περιέχουσι δὲ ἀριθμοὶ πρῶτοι καὶ
 ταῦτα τὰ τρία τετράχορδα κοινοὶ μὲν τῶν ἄκρων ὁ τε τῶν Μ^ι,ςξ' καὶ
 ὁ τῶν Μ^{ιβ} ρχπ'. ἴδιοι δὲ τῶν μὲν δευτέρων ἀπὸ τῶν ἡγουμένων ὁ τε
 τῶν Μ^{ιγ},βωκε' καὶ ὁ τῶν Μ^{ιβ},ζφιβ' καὶ ὁ τῶν Μ^{ιγ},γ'λο'. τῶν δὲ τρίτων [10]
 ὁ τε τῶν Μ^{ιγ},ηχ' καὶ ὁ τῶν Μ^{ιγ},ςχκ' καὶ ὁ τῶν Μ^{ιγ},εσμ' ὡς ἔχουσιν
 αἱ καταγραφαί.

ἐναρμόνιον	χρῶμα μαλακόν	χρῶμα σύντονον
Μ ^ι ,ςξ' ἐπὶ δ'	Μ ^ι ,ςξ' ἐπὶ ε'	Μ ^ι ,ςξ' ἐπὶ ς'
Μ ^{ιγ} ,βωκε' ἐπὶ κγ'	Μ ^{ιβ} ,ζφιβ' ἐπὶ ιδ'	Μ ^{ιβ} ,γ'λο' ἐπὶ ια'
Μ ^{ιγ} ,ηχ' ἐπὶ με'	Μ ^{ιγ} ,ςχκ' ἐπὶ κζ'	Μ ^{ιγ} ,εσμ' ἐπὶ κά'
Μ ^{ιβ} ρχπ'	Μ ^{ιβ} ρχπ'	Μ ^{ιβ} ρχπ'

45 and 48, and their mean numbers in equal excesses are 46 and 47. Now since 47 does not make an epimoric ratio with both the extremes, but only 46 does so, making with 48 the ratio 24:23, and with 45 the ratio 46:45, the greater ratio, 24:23, will be conjoined with the ratio 5:4 because of our initial postulates, and the remaining ratio, 46:45, will fill up the 'following' ratio. Again, if we take the first numbers that make the ninth-in-addition ratio, that is, 9 and 10, and triple them, we shall get 27 and 30, and their means in equal excesses are 28 and 29. But 29 does not make an epimoric ratio with both the extremes, whereas 28 makes with 30 the ratio 15:14, and with 27 the ratio 28:27, so that here too the ratio 15:14 is conjoined with the ratio 6:5, and the ratio 28:27 is left in the 'following' position. Similarly, if we take the first numbers that make the seventh-in-addition ratio, which are 7 and 8, and triple them, we shall get 21 and 24, and their means in equal excesses are 22 and 23. Since the latter does not make an epimoric ratio with both the extremes, but only 22 does so, making with 24 the ratio 12:11, and with 21 the ratio 22:21, here too the ratio 12:11 will be conjoined with the ratio 7:6, and the ratio 22:21 will have the 'following' position.

Now since of all the genera the enharmonic is softest, there is as it were a road from it towards the more tense, by a process of increase through first the softer chromatic, then the tenser, towards the succeeding genera that are *apykna* and diatonic (in all cases those that have the larger leading ratio are perceived as softer, and those that have the smaller one are perceived as tenser). We have therefore attached the tetrachord put together from the ratios 5:4, 24:23 and 46:45 to the enharmonic genus; that put together from the ratios 6:5, 15:14 and 28:27 to the softer of the chromatics; and that put together from the ratios 7:6, 12:11 and 22:21 to the more tense of the chromatics. The first numbers that contain these three tetrachords are these: common <to all three genera>, those of their extremes, 106,260 and 141,680; peculiar <to each genus individually> those of the ones second from the leaders, 132,825 and 127,512 and 123,970; and those of the ones that come third, 138,600 and 136,620 and 135,240. These are shown in the table below.

Enharmonic	Soft chromatic	Tense chromatic
106,260	106,260	106,260
5:4	6:5	7:6
132,825	127,512	123,970
24:23	15:14	12:11
138,600	136,620	135,240
46:45	28:27	22:21
141,680	141,680	141,680

- (7) Ἐστί μὲν οὖν τὰ πλεῖστα τούτων σαφῆ διὰ τὴν προειρημένην διδασκαλίαν. ζητεῖ δέ, ποιῶ λόγῳ τοὺς προκειμένους ἀριθμοὺς εὗρεν. ἔχει δὲ λόγον ἢ εὗρεσις αὐτῶν τοιοῦτον.
- (10) Ἐκεῖνου γὰρ τοῦ δ' καὶ τοῦ γ' ἐν ἐπὶ γ' λόγῳ, τοῦτο διεΐλεν εἰς τρεῖς λόγους, εἷς τε τὸν ἐπὶ με' καὶ τὸν ἐπὶ κγ' καὶ τὸν ἐπὶ δ', ὥστ' ἀναγκαῖον ἔστι συστήσασθαι τοὺς τρεῖς λόγους κατὰ τὸ ἐξῆς. τοῦτο δ' ἔσται οὕτως· ἐπειδὴ πυθμένες τοῦ ἐπὶ γ' λόγου ὃ τε δ' ἔστί καὶ ὁ γ', δεῖ δὲ τὸν γ' ἔχειν τέταρτον· ἔσται ἀντὶ μὲν τοῦ γ' ὁ ιβ', ἵν' ἔχη τέταρτον καὶ
- (15) γένηται ὁ ιε' ἐπὶ δ' τοῦ ιβ'· ὥς γίνεσθαι ις' ιε' ιβ'· ὁ γὰρ ιε' τοῦ ιβ' ἐπὶ δ'. πάλιν ἐπεὶ δεῖ τοῦ ιε' ἐπὶ κγ' τινὰ εὗρεῖν, δεῖ τὸν ιε' ἔχειν κγ'· ἴσχει δ' ἐπὶ τὸν κγ' γενόμενος· ὥστε τάξωμεν ἀντὶ μὲν τοῦ ιε' τὸν τμε', ἀντὶ δὲ τοῦ ιβ' τὸν σος', ἀντὶ δὲ τοῦ ις' τὸν τζη'. ὥστε γίνεσθαι ἐπὶ κγ' τοῦ τμε' τὸν τξ', οὗ ἔστιν ἐπὶ με' ὁ τζη'. ἔσται οὖν τὸ πρῶτον τε-
- (20) τράχορδον ἐν ἀριθμοῖς τοῖς τζη' καὶ τξ' καὶ τμε' καὶ σος'.
- Τὸ δὲ δεύτερον συντίθεται οὕτως· ἐπεὶ γὰρ δεῖ πάλιν συγκεῖσθαι τὸν ἐπίτριτον λόγον ἔκ τε τοῦ ἐπὶ κζ' καὶ ἐπὶ ιδ' καὶ ἐπὶ ε', δεῖ ἄρα τὸν γ' πέμπτον ἔχειν· τάσσομεν οὖν ἀντὶ μὲν τοῦ γ' τὸν ιε', ἀντὶ δὲ τοῦ δ' τὸν κ'· καὶ ἔσται ὁ τοῦ ιε' ἐπὶ ε' ὁ ιη', οὗ δεῖ ἐπὶ ιδ' λαβεῖν· δεῖ ἄρα
- (25) τὸν ἀντὶ τοῦ ιη' τασσόμενον ἔχειν ιη' καὶ ιδ'· ἐπτάκις δὲ γενόμενος ὁ ιη' γίνεται ρκς' καὶ ἴσχει καὶ ιη' καὶ ιδ', ὥστ' ἐπὶ ιδ' τοῦ ρκς' <τὸν ρλε', οὗ ἔστιν ἐπὶ κζ' ὁ ρμ'. ἔσται οὖν τὸ δεύτερον τετράχορδον ἐν ἀριθμοῖς τοῖς ρμ' καὶ ρλε' καὶ ρκς' καὶ ρε'.>

10 ἐν om. p 11 ἐπὶ με'] ἐπίμεσον p 18 σος] σοβ' G 19 ἐπὶ με'] ἐπίμεσος p 20 τοῖς] τῷ V¹⁸⁷ G τοῦ p σος] σις' p 25 ἀντὶ Alexanderson αὐτόν codd. αὐτόν <ἀντί> Wallis et Düring; lacuna magna in textu g 1δ] 1θ' codd. 27-8 <τὸν - ρε'> add. Düring; lacuna magna in textu g

Most of these statements are clear, on the basis of the preceding exposition. But consider by what sort of reasoning Ptolemy has found the numbers set out above. Their discovery is based on reasoning of the following sort.⁶⁶⁴

| He has taken the 4 and 3 in epitritie ratio, and has divided it into three ratios, into 46:45, 24:23 and 5:4, so that one can combine the three ratios in sequence. This will come about as follows. Since the foundations of the epitritie ratio are 4 and 3, the 3 must have a quarter. 12 will take the place of 3, so that it may have a quarter, and that | 15 may be in the ratio 5:4 with 12. Thus we get 16, 15, 12, for 15 is in the ratio 5:4 with 12. Again, since we must find a number which is in the ratio 24:23 with 15, 15 must contain 23, and it does so when it is multiplied by 23. So let us put 345 in place of 15, 276 in place of 12, and 368 in place of 16. Thus the number in the ratio 24:23 with 345 is 360, to which 368 is in the ratio 46:45. Then the first tetrachord | will be in the numbers 368, 360, 345, 276.

The second is put together as follows. Since this time the epitritie ratio must be composed out of the ratios 28:27, 15:14 and 6:5, the 3 must have a fifth. We therefore put 15 in place of 3, and 20 in place of 4; and the number in the ratio 6:5 with 15 will be 18, with which we must find a number in the ratio 15:14. Then the number | put in place of 18 must contain both 18 and 14. When 18 is multiplied by 7 it becomes 126 and contains both 18 and 14, so that the number in the ratio 15:14 with 126 is 135, to which 140 is in the ratio 28:27. Thus the second tetrachord is in the numbers 140, 135, 126, 105.

⁶⁶⁴ The laborious explanations that follow are adequate to their task. But Porphyry does not explain or even mention the most puzzling feature of Ptolemy's procedure or the enigmatic justification he offers for it. He selects one ratio from each of the ratio-pairs into which he has just divided the ratio of the fourth, 4:3, and this in turn is to be divided into two smaller ratios. These and the undivided ratio in the initial pair will become the ratios of the three intervals in the relevant tetrachord. Why, then, does Ptolemy first divide the selected ratio into three sub-ratios and then reduce them to two by combining two of them (*Harm.* 34.10–12), rather than dividing it into two immediately? This can be done straightforwardly if we double the terms of the ratio instead of tripling them as Ptolemy does. Thus we would represent 16:15 as 32:30, and would then insert the intervening number to give the epimoric ratios 32:31 and 31:30, as in Didymus' enharmonic division (see the tables of *Harm.* II.14, and cf. Eratosthenes' enharmonic and chromatic). Ptolemy says that he first triples the numbers 'because by these means the three ratios of the tetrachord are at once produced' (34.12–13), but I do not see how this can have any bearing on the issue. Perhaps he thought that his procedure gave the results that a musical ear would accept, but that is not what he says, and in any case leaves the manoeuvre without any 'rational' (mathematical) justification. It is unsurprising that Porphyry finds none, but strange that he apparently overlooks the problem.

- Πάλιν ἐπεὶ τὸ τρίτον τετράχορδον συνέστηκεν ἔκ τε τοῦ ἐπὶ κα' καὶ
 (30) ἐπὶ ια' καὶ ἐπὶ ς', δεῖ ἄρα τὸν ἀντὶ τοῦ γ' ἕκτον ἔχειν, ὥστ' ἔσται ὁ
 (146) ς'. καὶ ὁ μὲν ἐπὶ γ' αὐτοῦ ἐστὶν ὁ η', ὁ δ' ἐπὶ ς' ὁ ζ'. πάλιν ἐπεὶ δεῖ
 τοῦ <ζ> ἐπὶ ια' λαβεῖν, δεῖ ἄρα τὸν ζ' ζ' ἔχειν ἀλλὰ καὶ ια' ἐνδεκάκις δὲ
 γενόμενος γίνεται ὁ οζ'· ὥστε ταγήσεται ἐν τῷ τετραχόρδῳ ἀντὶ μὲν
 τοῦ ς' ὁ ξς', ἀντὶ δὲ τοῦ ζ' ὁ οζ'· ὁ δὲ τούτου ἐπὶ ια' ὁ πδ'· ἀντὶ δὲ
 (5) τοῦ η' ὁ πη'· ὡς εἶναι καὶ τοῦτο τὸ τετράχορδον ἐν τοῖς πρώτοις ἀριθ-
 μοῖς, ὡς δεδήλωται.

- Ἄλλ' ἐπεὶ μὲν βούλεται τοὺς ἄκρους τῶν τετραχόρδων τοὺς περιέχον-
 τας τὸν ἐπίτρίτον λόγον κοινούς εἶναι τῶν τριῶν τετραχόρδων, ἀναγκα-
 (10) ὦν ἐστὶν εὐρεῖν τινα ἀριθμόν, ὃς ἔξει μέτρα ὁμώνυμα τοῖς ἄκροις τῶν
 τριῶν τετραχόρδων. ἐὰν δ' εὕρω τὸν ἐλάττονα τῶν ἄκρων ἔχοντα τὰ
 προκείμενα μέρη καὶ προσθῶ τὸ τρίτον, εὐρήσω καὶ τὸν μείζονα. ἔστι
 δ' ὁ ἐλάττων ἐν μὲν τῷ πρώτῳ τετραχόρδῳ ὁ σος', ἐν δὲ τῷ δευτέρῳ ὁ
 ρε', ἐν δὲ τῷ τρίτῳ ὁ ξς'. δεῖ οὖν ἀριθμόν εὐρεῖν, ὃς ἔξει ξς' ρε' σος'.
 εὐρίσκω δὲ τοῦτο οὕτως· τοῦ μὲν ξς' καὶ τοῦ ρε' τὸ μέγιστον κοινὸν
 (15) μέτρον ἐστὶν ὁ γ'· καὶ ἐὰν λάβω τὸ τρίτον τοῦ ξς', ὃ ἐστὶ τὰ κβ', καὶ
 πολλαπλασιάσω ἐπὶ τὸν ρε', γίνεται ,βτι'. ἀλλ' ἐπεὶ θέλω αὐτὸν ἔχειν
 καὶ σος', λαμβάνω πάλιν τὸ μέγιστον κοινὸν μέτρον τοῦ σος' καὶ τοῦ
 ,βτι'· ἔστι δ' ὁ ς' λαβὼν οὖν τὸ ς' τοῦ σος', ὃ ἐστὶ μς' πολλαπλασιά-
 ζω ἐπὶ τὸν ,βτι' καὶ γίνεται ὁ τῶν Μ'ςσξ' ἀριθμός, οὗ εὐρεθέντος καὶ
 (20) οἱ λοιποὶ δῆλοι εἰσι, καθ' ἃ γέγραπται. τὸ τρίτον τῶν Μ'ςσξ' γινόμενον
 Μ'γευκ' ἐὰν προσθῶ αὐτοῖς, γίνεται ὁ μείζων Μ'δρχπ' τῶν τριῶν τε-
 τραχόρδων. καὶ ἐν τῷ αὐτῷ λόγῳ τὸ μὲν πρῶτον τετράχορδον τξή τξ'
 τμε' σος' πρὸς Μ'δρχπ' Μ'γ,ηχ' Μ'γ,βωκε' Μ'ςσξ'· τὸ δὲ δεύτερον
 ρμ' ρλε' ρκς' ρε' πρὸς Μ'δρχπ' Μ'γ,ςχκ' Μ'β,ζφιβ' Μ'ςσξ'· τὸ δὲ
 (25) τρίτον πη' πδ' οζ' ξς' πρὸς Μ'δρχπ' Μ'γ,εσμ' Μ'β,γ,γλὸ Μ'ςσξ'.

Ἐπὶ δὲ τῶν ἀπύκνων γενῶν ἀκολουθού τοῖς προδιωρισμένοις ὄντος
 τοῦ τοὺς μὲν ἐλάττονας τῶν ἐκ τῆς πρώτης καὶ εἰς δύο διαιρέσεως τοῦ
 ἐπιτρίτου λόγων ἀνάπαλιν ἐπὶ τῶν ἡγουμένων τιθῆναι τόπων, τοὺς δὲ [15]
 μείζονας τῶν συζυγούντων αὐτοῖς καταδιαιρεῖν τὸν αὐτὸν τρόπον εἰς
 τοὺς δύο τοὺς ἐπομένους, ὁ μὲν ἐπὶ ιε' οὐχ εὐρίσκεται δυνατὸς ὢν τὸν
 ἡγούμενον ἐπισχεῖν τόπον. ἐὰν γάρ τοὺς ποιοῦντας ἀριθμούς τὸν λοι-

30 ἀντὶ Alexanderson αὐτόν codd. ἕκτον Wallis ἕκαστον codd.

2 <ζ> add. Alexanderson τὸν ζ' ζ' Wallis τὸν ζ' ἐνδεκάτον codd.
 Alexanderson τούτου codd. 8 τριῶν om. p 12 σος'] σς' p
 codd.

4 οζ' p ος' ceteri 5 τοῦτο
 18 τὸ ς' Alexanderson τὸν ς'

Again, since the third tetrachord was put together from 22:21, | 12:11 and 7:6, the number put in place of 3 must have a sixth, and it will therefore be 6. The number in epitritetic ratio with it is 8, and the number in the ratio 7:6 is 7. Again, since we must find the number in the ratio 12:11 with 7, the 7 must contain both 7 and 11. When multiplied by 11 it becomes 77. Thus in place of 6 in the tetrachord will be put 66, and in place of 7 will be 77. The number in the ratio 12:11 with it is 84; and in place | of 8 is 88. Thus this tetrachord too will be in its primary numbers, as has been shown. [146D]

But since Ptolemy wants the numbers in the tetrachords which bound the epitritetic ratio to be common to the three tetrachords, one must find some number which will have measures with the same names as do the extreme terms of the | three tetrachords.⁶⁶⁵ And if I find the smaller of the extreme terms which contains the parts that have been set out, and add a third of it, I shall find the greater term too. In the first tetrachord the smaller term is 276, in the second 105 and in the third 66. We must therefore find a number which will contain 66, 105 and 276. I find it as follows. The greatest common | measure of 66 and 105 is 3; and if I take a third of 66, which is 22, and multiply it with 105, it becomes 2310. But since I want it also to contain 276, I take again the greatest common measure of 276 and 2310; and it is 6. Taking, then, a sixth of 276, which is 46, I multiply it with 2310, and it becomes the number 106,260; and once this has been found, | the rest are obvious from what has already been written. If I add to it a third of 106,260, which is 35,420, the greater term of the three tetrachords becomes 141,680. And the first tetrachord, 368, 360, 345, 276 is in the same ratio as 141,680, 138,600, 132,825, 106,260; the second, 140, 135, 126, 105 is in the same ratio as 141,680, 136,620, 127,512, 106,260; and the | third, 88, 84, 77, 66, is in the same ratio as 141,680, 135,240, 123,970, 106,260.

As to the *apykna* genera, it follows from our previous definitions that the smaller ratios of those arising from the first division of the epitritetic ratios, the division into two, should here, by contrast, be placed in the leading

⁶⁶⁵ The point is that the number in question (the smaller of the terms in epitritetic ratio, as the sequel shows) must have factors which stand in the same relations to it as do those required for the corresponding terms in all three of the divisions. Thus if the number must be divisible by 4, as in the first tetrachord, by 5 as in the second and by 6 as in the third, the number now sought must have factors in all these relations with it. These factors are named by their relation to the relevant term (e.g. as one sixth of it), and will therefore have the same names wherever they occur, no matter how big the individual numbers may be.

πὸν καὶ ἐπὶ δ', τουτέστι τὸν δ' καὶ τὸν ε' τριπλασιάσωμεν πάλιν, ἵνα [36] ποιήσωσι τὸν ιβ' καὶ τὸν ιε', καὶ μέσοι πέσωσι κατ' ἴσας ὑπεροχὰς ὅ τε ιγ' καὶ ὁ ιδ', ὁ μὲν ιγ' πρὸς ἀμφοτέρους τοὺς ἄκρους οὐ ποιήσει λόγον ἐπιμόριον, ὁ δὲ ιδ' πρὸς μὲν τὸν ιβ' ἐπὶ ζ', πρὸς δὲ τὸν ιε' ἐπὶ ιδ', ὧν οὐδέτερον ἐγχαρήσει τιθῆναι κατὰ τὸν ἐπόμενον τόπον, μείζονα ἐσόμενον τοῦ κατὰ τὸν ἡγούμενον, τουτέστι τοῦ ἐπὶ ιε' παρὰ τε τὴν ἐνάρ- [5] γειαν αὐτὴν καὶ τὸν ἐξαρχῆς λόγον. τοῦ δὲ ἐπὶ ζ' τασσομένου κατὰ τὸν ἡγούμενον τόπον, οἱ τὸν λοιπὸν καὶ ἐπὶ ζ' περιέχοντες ἀριθμοὶ πρῶτοι, ὁ τε ζ' καὶ ὁ ζ', τριπλασιασθέντες ὁμοίως ποιήσουσι τὸν ιη' καὶ τὸν κ', μέσων ἐν ἴσας ὑπεροχαῖς λαμβανομένων τοῦ τε ιθ' καὶ τοῦ κ'. οἱ μὲν οὖν ιθ' πάλιν οὐ ποιήσει πρὸς ἀμφοτέρους τοὺς ἄκρους ἐπιμόριον [10] λόγον, ὁ δὲ κ' πρὸς μὲν τὸν ιη' ἐπὶ θ', πρὸς δὲ τὸν κ' ἐπὶ κ', ὧν ὁμοίως ὁ μὲν μείζων καὶ ἐπὶ θ' συναφθήσεται τῷ ἐπὶ ζ', ὁ δὲ ἐλάττων καὶ ἐπὶ κ' τὸν ἐπόμενον συμπληρώσει λόγον. κατὰ ταῦτά δὲ καὶ τοῦ ἐπὶ θ' τασσομένου κατὰ τὸν ἡγούμενον τόπον, ἐὰν οἱ τὸν λοιπὸν καὶ ἐπὶ ε' περιέχοντες ἀριθμοί, ὁ ε' καὶ ὁ ζ', τριπλασιασθέντες ποιήσωσι τὸν [15] ιε' καὶ τὸν ιη', μέσων ἐν ἴσας ὑπεροχαῖς πιπτόντων τοῦ τε ις' καὶ τοῦ ιζ'. ὁ μὲν ις' πρὸς ἀμφοτέρους τοὺς ἄκρους οὐ ποιήσει λόγον ἐπιμόριον, ὁ δὲ ις' πρὸς μὲν τὸν ιη' ἐπὶ η', πρὸς δὲ τὸν ιε' ἐπὶ ιε', ὥστε τὸν μὲν μείζονα καὶ ἐπὶ η' συνάπτεσθαι τῷ ἐπὶ θ', τὸν δὲ λοιπὸν καὶ ἐπὶ ιε' ἐφαρμόζειν τῷ ἐπομένῳ τόπῳ. ἀλλὰ πρὸ τούτων πάντων τῶν λόγων [20] ὁ ἐπὶ η' εὐρηται καθ' αὐτὸν περιέχων τὸν τόνον ἐκ τῆς ὑπεροχῆς τῶν δύο πρῶτων συμφωνιῶν, οὐ κατὰ τὸ εὐλογόν τε καὶ ἀναγκαῖον ὀφείλοντος καὶ τὸν ἡγούμενον ἐπισχεῖν τόπον τῶν ἐγγιστα πρὸς αὐτὸν συναπτομένων, διὰ τὸ μηδένα τῶν ἐπιμορίων συμπληροῦν μετ' αὐτοῦ τὸν ἐπίτριτον. ὁ μὲν ἐπὶ θ' φθάνει συνημμένος αὐτῷ κατὰ τὴν προεκτεθει- [25] μένην διαίρεσιν, ὁ δὲ ἐπὶ ζ' οὐκέτι. διὸ τοῦτον μὲν ἐπὶ τοῦ μέσου τόπου συνάψομεν αὐτῷ, τὸν δὲ λοιπὸν εἰς τὸν ἐπίτριτον, τουτέστι τὸν ἐπὶ κζ', ἀποδώσομεν τῷ ἐπομένῳ τόπῳ. κάνταυθα δὴ πάλιν ἀκολούθως τῷ μεγέθει τῶν ἡγουμένων λόγων τὸ μὲν συντιθέμενον τετράχορδον ἔκ τε τοῦ ἐπὶ ζ' καὶ τοῦ ἐπὶ θ' καὶ τοῦ ἐπὶ κ' προσάψομεν τῷ μαλακῷ [30] διατονικῷ, τὸ δὲ συντιθέμενον ἔκ τε τοῦ ἐπὶ θ' καὶ τοῦ ἐπὶ η' καὶ τοῦ ἐπὶ ιε' τῷ συντόνῳ διατονικῷ, τὸ δὲ συντιθέμενον ἔκ τε τοῦ ἐπὶ η' καὶ τοῦ ἐπὶ ζ' καὶ τοῦ ἐπὶ κζ' τῷ μεταξύ πως τοῦ μαλακοῦ καὶ τοῦ συντόνου, κληθέντι δ' ἂν εὐλόγως τονιαίῳ διὰ τὸ τηλικούτου εἶναι τὸν ἡγούμενον αὐτοῦ τόπον. περιέχουσι δὲ καὶ ταῦτα τὰ τρία τετράχορδα [35] [37] πρῶτοι ἀριθμοὶ κοινὸι μὲν τῶν ἄκρων ὁ τε τῶν φδ' καὶ ὁ τῶν χοβ', ἴδιοι δὲ τῶν μὲν δευτέρων ἀπὸ τῶν ἡγουμένων ὁ τε τῶν φος' καὶ ὁ τῶν φξξ' καὶ ὁ τῶν φξ', τῶν δὲ τρίτων ὁ τε τῶν χμ' καὶ ὁ τῶν χμη' καὶ ὁ

positions, and that the greater ratios coupled with them should be divided in the same way into the two 'following' ratios. Now the ratio 16:15 is found to be incapable of occupying the leading position. For if we take the numbers making the remaining ratio, 5:4, which are 4 and 5, and once again triple them to make 12 and 15, there will fall as means with equal excesses 13 and 14. Now 13 will not make an epimoric ratio with both the extremes, while 14 will make the ratio 7:6 with 12 and the ratio 15:14 with 15, neither of which can legitimately be placed in the 'following' position, since each will be greater than that in the leading position, that is, than the ratio 16:15, contrary both to what is perceptually evident and to our initial thesis.

When the ratio 8:7 is put in the leading position, however, the first numbers bounding the remaining ratio, 7:6, which are 6 and 7, when tripled in the same way will make 18 and 21, whose means, taken in equal excesses, are 19 and 20. Then 19, once again, will not make an epimoric ratio with both the extremes, but 20 will make the ratio 10:9 with 18, and the ratio 21:20 with 21, of which the greater, 10:9, will be conjoined, as before, with the ratio 8:7, while the lesser, 21:20, will fill out the 'following' ratio. In the same way, when the ratio 10:9 is put in the leading position, if the numbers bounding the remaining ratio, 6:5, which are 5 and 6, are tripled, they will make 15 and 18, whose means falling in equal excesses are 16 and 17. Now 17 will not make an epimoric ratio with both the extremes, but 16 will make the ratio 9:8 with 18, and the ratio 16:15 with 16, so that the greater, 9:8, is conjoined with the ratio 10:9, while the remaining one, the ratio 16:15, is attuned to the 'following' position.

But prior to all these ratios, the ratio 9:8 was found in its own right to contain the tone arising from the differences between the first two concords; and according to what is both rational and necessary, this ratio ought also to occupy the leading position, those closest to it being conjoined with it, since none of the epimoric ratios fills out the epitritie ratio. The ratio 10:9 has already been conjoined with it in the division set out above, but the ratio 8:7 has not yet. Hence we shall conjoin this with it, in the middle position, and allocate the remainder making up the epitritie ratio, which is the ratio 28:27, to the 'following' position.

Here, once again, in correspondence with the magnitude of the leading ratios, we shall attach the tetrachord put together from the ratios 8:7, 10:9 and 21:20 to the soft diatonic, that put together from the ratios 10:9, 9:8 and 16:15 to the tense diatonic, and that put together from the ratios 9:8, 8:7 and 28:27 to the one lying somehow between the soft and the tense, which is called 'tonic', reasonably enough, because that is the size of its leading position. The first numbers that contain these three tetrachords are these: common <to all three genera>, those of the extremes, 504 and 672; peculiar <to each genus individually>, those of the ones second from the leaders, 576 and 567 and 560; and those of the ones

τῶν χλ'. ὡς ἔχουσιν αἱ καταγραφαί.

διατονικὸν μαλακόν		διατονικὸν τοιμαῖον		διατονικὸν σύντονον	
φδ'	ἐπὶ ζ'	φδ'	ἐπὶ η'	φδ'	ἐπὶ θ'
φος'	ἐπὶ θ'	φξζ'	ἐπὶ ζ'	φξ'	ἐπὶ η'
χμ'	ἐπὶ κ'	χμη'	ἐπὶ κζ'	χλ'	ἐπὶ ιε'
χοβ'		χοβ'		χοβ'	

- (30) Ἐπεὶ ὁ τ' ἐπίτритος λόγος, καθὼς ἀπέδειξε, σύγκειται ἐκ τοῦ ἐπὶ δ' καὶ τοῦ ἐπὶ ιε', ἀναγκαῖον δ' ἐστὶν ἐν τῇ τῶν διατονικῶν διαιρέσει καὶ τὸν ἐλάττονα λόγον πρὸς τῷ ἡγουμένῳ τάσσειν, τουτέστι τῷ ὀξυτάτῳ,
- (147) ἐπεὶ οἱ ἐλάττονες ἀριθμοὶ ἡγοῦνται πρὸς τὸ τοὺς δύο τοὺς ἐπομένους μείζοντας εἶναι τοῦ ἡγουμένου ἀνάπαλιν τοῖς ἔχουσιν τὸ πυκνόν, ἔταξε τὸν μὲν ἐπὶ ιε' ἐν τῷ ἡγουμένῳ, τὸν δ' ἐπὶ δ' διαιρεῖ εἰς δύο τοὺς ἐπομένους. ἐκθέμενος οὖν τὸν ε' καὶ τὸν δ' τριπλασιάζει αὐτοὺς καὶ γίνονται ὁ τε ιβ' (5) καὶ ὁ ιε'. τούτων μέσοι ἐν ἴσαις ὑπεροχαῖς πίπτουσιν ὁ τε ιδ' καὶ ιγ'. καὶ ὁ μὲν ιγ' οὐ ποιεῖ πρὸς ἐκάτερον τῶν ἄκρων ἐπιμόριον λόγον, ὁ δὲ ιδ' πρὸς μὲν τὸν ιε' ποιεῖ τὸν ἐπὶ ιδ' λόγον, πρὸς δὲ τὸν ιβ' τὸν ἐπὶ ζ'. καὶ ἐὰν τάξωμεν ἐν ὁποτέρῳ οὖν τῶν διαστημάτων τὸν ἐπὶ ζ' λόγον, ἄτοπον συμβήσεται ἄχρηστος γὰρ ἐκάτερος τῶν ἐπομένων λόγος ὁ τ' (10) ἐπὶ ιδ' καὶ ὁ ἐπὶ ζ' μείζων γὰρ ἐστὶ τοῦ ἡγουμένου, τουτέστι τοῦ ἐπὶ ιε'. ὁ γὰρ ἐπόμενος λόγος τοῦ ἡγουμένου μείζων ἔσται. θεωρηθήσεται δ' ἐν πρώτοις ἀριθμοῖς ἐν τε τῷ με' καὶ μή καὶ νς' καὶ ξ'. ἐν τούτοις μὲν οὖν τοῖς τετραχόρδοις ὁ ἐπὶ ζ' τὸ μέσον ποιεῖ διάστημα καὶ ὁ λοιπὸς ὁ ἐπὶ ιδ' τοῦ ἐπομένου καὶ ἔστι μείζων τοῦ ἡγουμένου τοῦ ἐπὶ ιε'. ἐν (15) δὲ τῷ τῶν ρε' ριβ' ρκ' ρμ' ὁ μὲν ἐπὶ ζ' τὸ ἐπόμενον ποιεῖ διάστημα, ὁ δ' ἐπὶ ιδ' τὸ μέσον. καὶ συνίστανται οἱ ἀριθμοὶ οὕτως. ἐπεὶ δεῖ τὸν γ' ἔχειν ιε' καὶ γ', ἵν' αὐτοῦ μὲν ἐπὶ ιε' γένηται ὁ μέσος ἀριθμός, ἐπίτритος δ' ὁ ἄκρος—ἔχει δὲ τοῦτο πρῶτος ὁ ιε', ὅτι ἔχει τρίτον ε' καὶ ιε' ἐν —τούτου ἐπὶ ιε' γίνεται ὁ ις'. θέλω δ' αὐτὸν ἔχειν καὶ [ἐπὶ] ιδ', ἵν' ὁ (20) ἐξῆς αὐτοῦ ἀριθμὸς γένηται ἐπὶ ιδ'. ζητῶ οὖν ποσάκις γινόμενος ὁ ις' ἴσχει καὶ ιδ'. λαμβάνω οὖν τὸ μέγιστον κοινὸν μέτρον τοῦ ιδ' καὶ τοῦ

14 ἐπὶ ιδ'] ἐπὶ ια' codd.

16 ἐπεὶ δεῖ] ἐπειδὴ p

19 [ἐπὶ] del. Alexanderson

that come third, 640 and 648 and 630. These are shown in the table below.

Soft diatonic	Tonic diatonic	Tense diatonic
504	504	504
8:7	9:8	10:9
576	567	560
10:9	8:7	9:8
640	648	630
21:20	28:27	16:15
672	672	672

Ptol. *Harm.* 35.13–37.4

Since the epitritie ratio, as Ptolemy has shown, is put together from the ratios 5:4 | and 16:15, and since in the division of the diatonics one must put the smaller ratio as the leading interval (that is, the highest), because the smaller numbers⁶⁶⁶ take the lead so that the two ‘following’ ones are <jointly> greater than the leading one, conversely to those that contain the *pyknon*, he has put the ratio 16:15 in the leading position, and divided the ratio 5:4 to form the two ‘following’ ratios. So having set down 5 and 4 he triples them, and they become 12 | and 15. Between them there fall as means in equal excesses the numbers 14 and 13. Now 13 does not make an epimoric ratio with both of the extremes, but 14 in relation to 15 makes the ratio 15:14, and in relation to 12 makes the ratio 7:6. And if we put the ratio 7:6 as either of the intervals, the result is anomalous; for each of the ‘following’ intervals, the ratios | 15:14 and 7:6, is useless, since each is greater than the leading ratio. The first numbers in which this will be seen are 45, 48, 56 and 60. In these tetrachords, then, the ratio 7:6 makes the middle interval, and the remaining ratio, 15:14, is that of the ‘following’ interval, and it is greater than the leading interval of 16:15. In | the numbers 105, 112, 120, 140, the ratio 7:6 makes the ‘following’ interval, and the ratio 15:14 is the middle one. The numbers are established as follows. Since the 3 must contain 15 and 3, so that the middle number may stand to it in the ratio 16:15 and to the <other> extreme term in epitritie ratio, and since the first number that does so is 15 (because it contains 5 as its third and 15 once), the number in the ratio 16:15 to it is 16. But I want it also to contain 14, so that the | next number to it can be in the ratio 15:14. So I ask what multiple of 16 also contains 14. I therefore take the greatest common measure of both

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⁶⁶⁶ More precisely, the smaller ratios.

- ις' καὶ ἔστιν ὁ δύο· καὶ ὁπότερον οὖν αὐτῶν μερίσας παρὰ τὸν δύο τὸν λοιπὸν πολλαπλασιάζω ἐπὶ τὸν ἕτερον, καὶ γίνεται τετράχορδον, ὥσπερ κεῖται ἐν πρώτοις ἀριθμοῖς ρε' ριβ' ρκ' ρμ'. καὶ ἐν ἑκατέρῳ τετραχόρδῳ
- (25) ὁ ἐπόμενος λόγος τοῦ ἡγουμένου μείζων ἐστίν, ὅπερ ἐστὶν ἄτοπον. ὥστ' οὐδεμία τῶν διαιρέσεων χρήσιμος ἔσται εἰς τὰ ἐξῆς τετράχορδα.
- Ἐν τοῖς πυκνοῖς τρισὶ τετραχόρδοις ὁ ἡγούμενος λόγος ὁ πρὸς τῷ ὀξυτάτῳ μείζων ἦν τῶν δύο λόγων τῶν πρὸς τῷ βαρυτέρῳ, ἐν δὲ τοῖς ἀπύκνοις, τὸ ἐναντίον, ὁ ἡγούμενος λόγος ὁ πρὸς τῷ ὀξυτέρῳ ἐλάττων
- (30) ἐστὶ τῶν δύο ἐπομένων τῶν πρὸς τῷ βαρυτέρῳ. ἐπεὶ οὖν διείλεν τὸ διὰ τεσσάρων, τουτέστι τὸν ἐπίτριτον λόγον, εἰς δύο λόγους ἀνίσους τριχῶς· εἰς γὰρ δύο ἴσους ἀδύνατόν ἐστι διὰ τὸ μὴ ἔχειν τὸν γ' πρὸς τὸν δ', ὃν τετράγωνος ἀριθμὸς πρὸς τετράγωνον ἀριθμόν· ὁ γὰρ τρία οὐκ ἔχει ὥς ὁ δ' δις δύο· διείλεν οὖν τὴν μὲν πρώτην εἰς ἐπὶ δ' καὶ ἐπὶ
- (35) ιε', τὴν δὲ δευτέραν διαιρέσιν εἰς ἐπὶ ε' καὶ εἰς ἐπὶ θ', τὴν δὲ τρίτην εἰς
- (148) ἐπὶ ζ' καὶ ἐπὶ ζ'. ἡ μὲν πρώτη διαίρεσις οὐ χρησιμεύει, καθὼς ἐδείξαμεν· ἔστι δὲ δευτέρα διαίρεσις, ἥτις ἐστὶν ἐξ ἐπὶ ε' καὶ ἐπὶ θ'. διείλε τάσας τὸν ἐλάττονα λόγον, ὅς ἐστιν ἐπὶ θ', πρὸς τῷ ἡγουμένῳ τὸν λοιπὸν καὶ ἐπὶ ε' διαίρει εἰς δύο λόγους καὶ εὐρίσκει συγκειμένους οὕτως. τρις
- (5) γὰρ ποιήσας τοὺς πυθμένας τοῦ ἐπὶ ε' λόγου τὸν τε ε' καὶ τὸν ζ' εὐρίσκει τὸν ιε' καὶ τὸν ιη', ὧν μέσοι εἰσὶν ὁ τε ις' καὶ ὁ ιζ'. ἀλλ' ὁ μὲν ιζ' οὐ ποιεῖ πρὸς ἑκάτερον τῶν ἄκρων ἐπιμόριον λόγον, τουτέστι τὸν ιε' καὶ τὸν ιη', ὁ δὲ ις' τοῦ μὲν ιε' ἐπὶ ιε', τοῦ δὲ ιη' ἐπὶ η'. ἔστι γὰρ παρὰ τὸν θ' αὐτοῦ· ὥς εἶναι τὸν ιη' τούτου ἐπὶ η'. εὐρίσκει οὖν τὸν ἐπὶ ε'
- (10) λόγον, ὃν ἔταξε νῦν πρὸς τῷ βαρυτέρῳ συγκείμενον ἐκ δύο λόγων, τοῦ τ' ἐπὶ η' καὶ τοῦ ἐπὶ ιε', καὶ τάσσει τὸν ἐπὶ η' λόγον πρὸς τῷ μέσῳ διαστήματι, ὥς εἶναι τοῦ τετραχόρδου τὴν διαιρέσιν ἐκ τε ἡγουμένου λόγου τοῦ πρὸς τῷ ὀξυτέρῳ τοῦ ἐπὶ θ' καὶ τοῦ ἐπὶ η' μέσου καὶ τοῦ βαρυτέρου ἐπὶ ιε'. διήρηται γὰρ ὁ ἐπὶ ε' καὶ εἰς ἐπὶ η' καὶ εἰς ἐπὶ ιε' καὶ ἔστιν ἐν
- (15) πρώτοις ἀριθμοῖς τετράχορδον λς' μ' με' μη'.

25 μείζων Wallis ἐλάττων codd.

28 πρὸς τῷ] πρῶτος p

9 ἐπὶ ε'] ἐπὶ θ' p

14 and 16, which is 2. Then after dividing one or the other of them by 2, I multiply the result by the other, and there will be a tetrachord of the sort whose primary numbers are 105, 112, 120, 140.⁶⁶⁷ And in each tetrachord | the ‘following’ ratio is greater than the leading one, which is anomalous. Thus none of these divisions is useful for the next group of tetrachords.⁶⁶⁸

In the three compressed (*pykna*) tetrachords,⁶⁶⁹ the leading ratio – the one for the highest interval – was greater than the two ratios for the lowest; but in the *apykna* tetrachords, by contrast, the leading ratio, the one for the highest interval, is smaller | than the two ‘following’ ratios used for the lowest. Then when he divided the fourth, that is, the epitritie ratio, into two unequal ratios in three ways (for it is impossible to divide it into equal ratios, since 3 is not related to 4 as a square number to a square number;⁶⁷⁰ for 3 is not like 4, which is twice 2), he made the first division into 5:4 and 16:15, | the second into 6:5 and 10:9, and the third into 7:6 and 8:7. The first division is no use, as we have shown; but the second division is usable, the one that is made up of 6:5 and 10:9. He divided it after putting the smaller ratio, which is 10:9, as the leading interval, and divided the remaining ratio, 6:5, into two ratios. He found what they are as follows. By tripling | the foundational numbers of the ratio 6:5, which are 5 and 6, he found 15 and 18, between which are 16 and 17. But 17 does not make an epimoric ratio with both of the extremes, that is, with 15 and 18, whereas 16 is in the ratio 16:15 with 15 and in the ratio 9:8 with 18 (for it is set beside the other’s 9, so that 18 stands to it in the ratio 9:8).⁶⁷¹ Thus he finds that the ratio 6:5, | which he now puts as the lowest interval, consists of two ratios, 9:8 and 16:15; and he puts the ratio 9:8 as the middle interval, so that the division of the tetrachord consists of 10:9 as the leading ratio for the highest interval, the ratio 9:8 as the middle interval, and the ratio 16:15 as the lowest. For the

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⁶⁶⁷ Porphyry has skipped a simple step here, versions of which he includes in the parallel calculations that follow. He has told us that we must divide one of the numbers, e.g. 14, by 2, making 7, and that we then multiply the other, 16, by 7, giving 112. We then calculate the number which is in the ratio 15:14 with 112, which is 120. Finally, we multiply the number 15, to which 16 is in the ratio 16:15, by the number by which 16 was multiplied, i.e. 7, giving us 105, and multiply 20 (which is in epitritie ratio with 15) by the same amount, giving 140.

⁶⁶⁸ That is, the diatonic ones.

⁶⁶⁹ I.e. those that contain *pykna*, the enharmonic and the two chromatics.

⁶⁷⁰ What Porphyry says can be generalised: no two successive numbers are both squares (or indeed cubes, etc.) of integers. The fact is easily understood, and shows clearly that no epimoric ratio can be divided into equal whole-number ratios; but it is rarely put in this lucid way by the musical theorists.

⁶⁷¹ The sense of the parenthesis is not entirely clear, but ‘the other’s 9’ probably means ‘the number of which the other is 9’, i.e. the number which taken 9 times makes 18; and 16 turns out to be 8 ‘of the same number.

- Εὐρηται δ' οὕτως. ἐκτιθέμεθα τὸν ἐπίτριτον γ' καὶ δ' καὶ τὸν ἐξῆς ἀριθμὸν ἐπὶ θ' εἶναι τοῦ ἡγουμένου. δεῖ ἄρα τὸν ἀντὶ τοῦ γ' τασσόμενον ἀριθμὸν ἔχειν γ' καὶ θ', ἵν' ἐπὶ θ' γένηται ἔχει δ' ὁ θ' πρῶτος τὸν γ' καὶ θ'. ἔσται οὖν ὁ μὲν ἡγούμενος θ', ὁ δὲ μετ' αὐτὸν ὦν ἐπὶ θ', ὁ
- (20) ἰ', καὶ ὁ περιέχων τὸ τετράχορδον, ὃς ἐστὶν ἐπίτριτος τοῦ θ', ἰβ'. πάλιν ἐπεὶ δεῖ τὸν ἐξῆς εἶναι τοῦ ἰ' ἐπὶ η', δεῖ ἄρα τὸν ἀντὶ τοῦ ἰ' τασσόμενον ἔχειν ἰ' καὶ η' ἐλάχιστον ὄντα τῶν ἐχόντων τὰ αὐτὰ μέρη. λαβὼν γὰρ τοῦ ἰ' καὶ τοῦ η' τὸ μέγιστον κοινὸν μέτρον τὸν β' μερίζω μὲν ὁπότερον οὖν αὐτῶν παρὰ τὸν β', καὶ τὸν λοιπὸν πολλαπλασιάζω ἐπὶ τὸν γενόμε-
- (25) νον, οἷον ὁ μὲν ἰ' παρὰ τὸν β' γίνεται ε', οὗτος ἐπὶ τὸν λοιπὸν τὸν η' ποιεῖ τὸν μ'. ἔσται οὖν ἀντὶ μὲν τοῦ ἰ' ὁ μ', ἀντὶ δὲ τοῦ θ' ὁ λς', διὰ τὸ τὸν μ' τοῦ ἰ' τετραπλάσιον εἶναι τὸν δὲ τοῦ μ' ἐπὶ η' [καί] τὸν με', τὸν δὲ τελευταῖον τοῦ τετραχόρδου <τὸν ἐπὶ ιε' τοῦ με'> καὶ αὐτὸν τετραπλάσιον τοῦ ιβ' τὸν μη'. ἔσται οὖν λς' μ' με' μη'.
- (30) Πάλιν ἐπεὶ ἡ τρίτη διαίρεσις τοῦ ἐπιτρίτου λόγου ἦν εἷς τ' ἐπὶ ζ' καὶ τὸν ἐπὶ ζ' διαιρεθεῖσα, τάσσει τὸν μὲν ἐπὶ ζ' πρὸς τῷ ὀξυτέρῳ, ὃ ἐστὶν ἡγούμενον, διαστήματι, τὸν δ' ἐπὶ ζ' διαιρεῖ εἰς δύο λόγους ὁμοίως τριπλασιάσας τοὺς πυθμένας τὸν τε ζ' καὶ τὸν ζ' καὶ γίνεται ιη' καὶ κ', ὦν μέσοι ὁ τε ιθ' καὶ κ'. καὶ ὁ μὲν ιθ' οὐκ ἴσχει πρὸς ἀμφοτέρους τοὺς
- (149) ἄκρους λόγον ἐπιμόριον, ὁ δὲ κ' τοῦ μὲν ιη' γίνεται ἐπὶ θ', ὁ δὲ κ' αὐτοῦ ἐπὶ κ'. ἔσται οὖν καὶ τὸ ἕτερον τετράχορδον, ὅπερ σύγκειται ἔκ τε ἡγουμένου λόγου τοῦ πρὸς τῷ ὀξυτέρῳ τοῦ ἐπὶ ζ' καὶ μέσου τοῦ ἐπὶ θ' καὶ βαρυτάτου τοῦ ἐπὶ κ'. εὐρεθήσονται δ' οἱ τετραχόρδου ἀριθμοὶ
- (5) πρῶτοι οὕτως.
- Ἐκτίθεμεν πάλιν τὸν ἐπὶ γ' ἐν πυθμένι τῷ γ' καὶ τῷ δ'. καὶ ἐπειδὴ δεῖ τὸν μετὰ τὸν γ' τασσόμενον ἀριθμὸν ἐπὶ ζ' εἶναι [ἀντὶ] τοῦ γ', δεῖ ἄρα τὸν ἀντὶ τοῦ γ' <τασσόμενον> ζ' ἔχειν καὶ γ' καὶ εἰσὶν ὁ ζ' καὶ ὁ γ' πρῶτοι πρὸς ἀλλήλους· ὁ ἄρα ὑπὸ τοῦ γ' καὶ τοῦ ζ' ἐλάχιστός ἐστι τῶν ἐχόν-
- (10) των γ' καὶ ζ'. ἔσται οὖν ἀντὶ μὲν τοῦ γ' κ', ὁ δὲ μετ' αὐτὸν ἐξῆς κδ'. καὶ ἐπεὶ δεῖ ἐπὶ θ' εἶναι τοῦ κδ', δεῖ ἄρα τὸν ἀντὶ τοῦ κδ' τασσόμενον θ' ἔχειν, ἀλλὰ καὶ κδ'. δεῖ ἄρα εὐρεῖν ἀριθμὸν, ὃς ἐλάχιστος ὦν ἔξει θ' καὶ κδ'. λαμβάνω τὸ μέγιστον κοινὸν μέτρον τοῦ θ' καὶ τοῦ κδ'· ἔστι δ' ὁ γ'. ἐὰν οὖν ὁπότερου αὐτῶν λαβὼν τὸν γ' ἐπὶ τὸν λοιπὸν πολλα-

17 γ] ζ V¹⁸⁷ ζ g 18–19 πρῶτος τὸν γ' Alexanderson πρῶτος τὸ γ' Wallis πρὸς τὸν ιγ' V¹⁸⁷ πρὸς τῷ
 ιγ' g πρῶτος ὁ γ' ceteri 23 μερίζομεν p 27 [καί] del. Düring 27–8 τὸν με' V¹⁸⁷ G τὸν μὲν p
 28 <τὸν ἐπὶ ιε' τοῦ με'> add. Düring 29 τετραπλάσιον Düring διπλάσιον codd. 33 καὶ κα']
 καὶ om. p

1 μὲν om. G 2 ἐπὶ κ' p ἐπὶ κ' Düring 4 τετραχόρδου Düring τετράχορδοι codd.
 5 πρῶτοι Düring πρῶτον codd. 7 [ἀντὶ] del. Düring 8 <τασσόμενον> add. Wallis

ratio 6:5 is divided into 9:8 and 16:15, and the tetrachord in its | primary numbers is 36, 40, 45, 48.

This is found as follows. We set out the epitrititic, 3 and 4, and the second number is in the ratio 10:9 with the leading one. Then the number put in place of 3 must contain 3 and 9, so that the ratio 10:9 can arise. The first number that contains 3 and 9 is 9. Then the leading number will be 9 and the next one, in the ratio 10:9, will be | 10, and the one that bounds the tetrachord, in epitrititic ratio with 9, will be 12. Again, since the next number must be in the ratio 9:8 with 10, the number put in place of 10 must contain 10 and 8, and must be the smallest number of those that have these parts. I take the greatest common measure of 10 and 8, which is 2, and divide one or the other of them by 2, and I multiply the other one with the result; | for instance 10 divided by 2 becomes 5, and this number multiplied by the other, 8, makes 40. Then 40 will be put in place of 10, and 36 in place of 9, since 40 is the quadruple of 10; and the number in the ratio 9:8 with 40 is 45, while the last number of the tetrachord, in the ratio 16:15 with 45, is itself the quadruple of 12, 48. There will thus be 36, 40, 45, 48.

| Again, since the third division of the epitrititic ratio was into 7:6 and 8:7, he puts the ratio 8:7 as the highest interval, which is the leading interval, and he divides the ratio 7:6 into two ratios in the same way as before, by tripling the foundational numbers, 6 and 7, making 18 and 21, between which are 19 and 20. And 19 does not have an epimoric ratio to both the extremes, whereas 20 is in the ratio 10:9 with 18, and 21 is related to it in the ratio 21:20. There will therefore be the other tetrachord, which consists of 8:7 as the leading ratio, the one for the highest interval, 10:9 as the middle one and 21:20 as the lowest. The primary numbers of the tetrachord are found | as follows.

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Once again we set out the epitrititic ratio in terms of its foundations, 3 and 4. And since the number put after 3 must be in the ratio 8:7 with 3, the number put in place of 3 must contain 7 and 3. Now 7 and 3 are prime to one another, and hence the product of 3 and 7 is the smallest of the numbers that contain | 3 and 7. Then in place of 3 is 21, and the next number after it in succession is 24. And since there must be a number in the ratio 10:9 with 24, the number put in place of 24 must contain 9 as well as 24. I take the greatest common measure of 9 and 24, which is 3. Then if I take a third of either number and multiply it by the other, | I shall have the number which contains both the parts. A third of 24 is 8, and this multiplied by 9 makes 72. I therefore put 72 in place of 24. The next number, in the ratio 10:9 with it, is 80. The leading number of the

- (15) πλασιάσω, ἔξω τὸν ἔχοντα ἄμφω τὰ μέρη· τοῦ δὲ κδ' τὸ τρίτον ἐστὶν ἡ, ταῦτα ἐπὶ τὸν θ' ποιεῖ τὸν οβ'. τάσσω οὖν ἀντὶ τοῦ κδ' τὸν οβ'· ὁ δὲ τούτου ἐξῆς καὶ ἐπὶ θ' ἔστιν ὁ π'. ὁ δὲ ἡγούμενος τοῦ τετραχόρδου ἔσται ὁ ξγ' τριπλασίων τοῦ κα', ἐπεὶ καὶ ὁ οβ' τοῦ κδ'. ὁ δὲ τελευταῖος καὶ ἐπόμενος ὁ πδ' καὶ αὐτὸς τριπλασίων τοῦ κη'· ἔσται οὖν ξγ' οβ' π' πδ'.
- (20) Ἀρέσκει δ' αὐτῷ καὶ ἕτερον εἶναι τετράχορδον ἐξ ἡγουμένου τονιαίου διαστήματος τοῦ ἐπὶ ἡ' καὶ μέσου τοῦ ἐπὶ ζ' καὶ τελευταίου τοῦ ἐπὶ κζ'. καὶ εὐρεθήσεται ἐν ἀριθμοῖς τῇ αὐτῇ ἐφόδῳ τῶν προεκτεθέντων ρξη' ρπθ' σις' σκδ'.
- (25) Ἐκκειμένων οὖν τῶν τετραχόρδων ἐν τοῖς εὐρεθεῖσιν ἀριθμοῖς, ἐπειδὴ τοὺς ἄκρους αὐτῶν τῶν τριῶν τετραχόρδων—εἰσι δ' οἱ ἄκροι καὶ ἐλάχιστοι ὁ λς' καὶ ὁ ξγ' καὶ ρξη'—ζητῶ πάλιν ἀριθμόν, δις ἔξει λς' ξγ' ρξη'. λαμβάνω πάλιν τοῦ λς' καὶ τοῦ ξγ' τὸ μέγιστον κοινὸν μέτρον· ἔστι δ' ὁ θ'· καὶ μερίσας τὸν λς' παρὰ τὸν θ' εὐρίσκω τὸν δ'· τοῦτον ποιήσας
- (30) ἐπὶ τὸν ξγ' γίνεται ὁ σνβ'· οὗτος ἔχει λς' καὶ ξγ'. θέλω δ' αὐτὸν ἔχειν καὶ ρξη'· λαμβάνω οὖν τοῦ σνβ' καὶ τοῦ ρξη' κοινὸν μέτρον· ἔστι δ' ὁ πδ'· λαβὼν <οὖν τὸ πδ' τοῦ ρξη', ὃ ἔστι τὰ β', πολλαπλασιάζω ἐπὶ τὸν σνβ'.
- (32a) πδ'· λαβὼν <οὖν τὸ πδ' τοῦ ρξη', ὃ ἔστι τὰ β', πολλαπλασιάζω ἐπὶ τὸν σνβ'.
- (32b) γίνεται> οὖν ὁ ἡγούμενος ἀριθμὸς τῶν τριῶν τετραχόρδων ὁ φδ', ὁ δὲ τελευταῖος καὶ ἐπὶ γ' τούτου κοινὸς πάλιν τῶν τριῶν τετραχόρδων χοβ'.
- (150) τοὺς δὲ λοιποὺς εὐρήσεις οὕτως. ἐπισκεψάμενος ὁπότερος τῶν ἄκρων τοῦ ὁμοταγοῦς αὐτῷ τοσαυταπλασίων ἐστὶ τοὺς μέσους τοῦ τετραχόρδου τοσαυταπλασίονας ποιήσων, οἷον ἐπεὶ τοῦ λς' ἐστὶν ὁ φδ' τεσσαρεσκαίδεκαπλασίων καὶ τοῦ <ξγ' ὁ φδ' ὀκταπλασίων καὶ τοῦ> ρξη' ὁ φδ' τριπλασίων, ποιήσων ἕκαστον μὲν τῶν τεσσάρων ἀριθμῶν λς' μ' με' μη' τεσσαρεσκαιδεκάκις· ἕκαστον δὲ τῶν ξγ' οβ' π' πδ' ὀκτάκις, ἕκαστον δὲ τῶν ρξη'

27 δς V¹⁸⁷ δν ceteri ξγ' ρξη' Wallis ρμ' ρσα' codd. 30 σνβ' V¹⁸⁷ ον' ceteri 31 τοῦ σνβ' Düring τὸν σνβ' codd. 32a-b <οὖν - γίνεται add. Alexanderson <οὖν τὸν ρξη' καὶ μερίσας παρὰ πδ' εὐρίσκω τὸν β'· τοῦτον ποιήσας ἐπὶ τὸ σνβ' γίνεται ὁ φδ'· ἔσται> Höeg (1934) 33 χοβ' Wallis χοδ' codd.

2 τοσαυταπλασίων] τοσαπλασίων g τοὺς μέσους Alexanderson τοῦ μέσου codd. 2-3 τοσαυταπλασίονας Alexanderson ποσαπλασίονα g τοσαυταπλασίονα ceteri 4 <ξγ' - τοῦ> add. Wallis 4-5 τριπλασίων] τεσσαρεσκαίδεκαπλασίων G 5 τεσσάρων om. G 6 ξγ' ρξη' p

tetrachord will be 63, the triple of 21, since 72 is the triple of 24; and the final, 'following' number will be 84, which is itself the triple of 28.⁶⁷² There will thus be 63, 72, | 80, 84.

Ptolemy is satisfied that there is another tetrachord too, made up from a leading interval of a tone in epogdoic ratio, a middle interval of 8:7, and a final one of 28:27. It will be found by the same method as those set out above, in the numbers 168, 189, 216, 224.⁶⁷³

| Now that the tetrachords have been set out in the numbers that have been found, since <we have found> the extreme terms of the three tetrachords individually – and the smaller extreme terms are 36, 63 and 168 – I again seek a number which will contain 36, 63 and 168. I take again the greatest common measure of 36 and 63, which is 9, and having divided 36 by 9 I find 4. Multiplying this | by 63 gives 252, which contains 36 and 63. But I want it also to contain 168. So I take the common measure of 252 and 168, which is 84. I therefore take an eighty-fourth of 168, which is 2, and multiply it by 252. Then the leading number of the three tetrachords becomes 504, and the final number, in epitritus ratio with it and common to all three tetrachords is 672.

You will find the others as follows. After finding that one or other of the extreme numbers is so many times the number coordinate with it,⁶⁷⁴ multiply the middle numbers of the tetrachord the same number of times. Then since 504 is 36 multiplied by 14, and 504 is 63 multiplied by 8, and 504 is 168 multiplied by 3, | multiply each of the four numbers 36, 40, 45 and 48 by 14, each of the numbers 63, 72, 80 and 84 by 8, and each of

[150D]

⁶⁷² The number 28 has not been mentioned before in this paragraph; it is the number which stands to 21 in the ratio 4:3, and therefore served as the lower boundary of the tetrachord when 21 was the upper.

⁶⁷³ Porphyry can be forgiven for declining to provide yet another analysis of the sort he has been offering, but by those standards he might have been content to present just one, and to say of all the others that they 'will be found by the same method'. It is a little odd that he avoids the task only in this case. He again misses an obvious opportunity for comment; Ptolemy's admission of this division among those he authorises is anomalous, and is not justified by any of the principles he has previously applied. Porphyry's expression, 'Ptolemy is satisfied...' (*areskei d' autōi...*), may perhaps signal a degree of detachment, suggesting that he is reluctant to commit himself to Ptolemy's position; cf. his similar use of the verb *areskein* when criticising Ptolemy at 51.9 above. (Of the two theoretically anomalous divisions described in I.16, the first, at *Harm.* 38.12–32, poses the same problem but in a milder form, since it is derived fairly satisfactorily by a variant of the method used in I.15. The difficulty does not affect the second, at 39.16–40.8, since Ptolemy represents it only as a practical musician's close approximation to one of those worked out in I.15, and does not suggest that it can be derived from his 'rational' principles; it is theoretically unsatisfactory but empirically adequate.)

⁶⁷⁴ Literally 'the number in the same rank as it', meaning the number that stood in the same position as 504 or 672 before the arithmetical adjustments were made.

ρπθ' σις' σκδ' τρίς' καὶ γίνονται ἀριθμοὶ σύμφωνοι ταῖς καταγραφαῖς.

λς'		φδ']ξγ'		φδ'	ρξη'		φδ'
	ἐπὶ θ'			ἐπὶ ζ'			ἐπὶ η'	
μ'		φς'	οβ'		φος'	ρπθ'		φςζ'
	ἐπὶ η'			ἐπὶ θ'			ἐπὶ ζ'	
με'		χλ'	π'		χμ'	σις'		χηη'
	ἐπὶ ιε'			ἐπὶ κ'			ἐπὶ κζ'	
μη'		χοβ'	πδ'		χοβ'	σκδ'		χοβ'

- (10) Τούτων οὖν δεδειγμένων ἐπεδείχθησαν, τίνες οἱ συντιθέντες τὸν ἐπι-
 τρίτον ἐπιμόριοι ἐλάττους μὲν ὄντες αὐτοῦ ἐν συμμετροῖς δ' ὑπεροχαῖς
 πρὸς ἀλλήλους θεωρούμενοι. καὶ γὰρ τὴν εἰς δύο ἐπιμορίους αὐτοῦ διαί-
 ρεσιν καὶ σύνθεσιν ὑπεδείξαμεν καὶ τὴν εἰς τρεῖς, ἐξ ὧν συντίθεται ἡ
 ἐλαχίστη τῶν συμφωνιῶν εἰς τὰς κατὰ γένος διαφοράς, τὰς τ' ἐν τοῖς
 μέλεσι χροᾶς ἐξαλλάττομεν.

- (15) Ἐν μὲν οὖν τοῖς ἐλάττοσι τοῦ ἐπιτρίτου ἐπιμορίοις ἐτάχθησαν εὐλόγως
 αἱ ἐμμελειαὶ οὐκ ἐν πᾶσι μέντοι, ἀλλ' ἐν τοῖς συντιθεῖσι τὸν ἐπιτρίτον.
 οὗτοι οἰκείως ἀπεδόθησαν ταῖς συντεθείσαις εἰς τὴν ἐλαχίστην συμφωνί-
 αν ἐμμελείαις, ἐπεὶ περ ἡ ἐλαχίστη συμφωνία ἐν ἐπιτρίτῳ λόγῳ ἀποδέδο-
 ται. τῶν συντιθέντων δὲ τὸ διὰ τεσσάρων ἐμμελῶν φθόγγων τοὺς ἐμ-
 μελεστέρους καὶ τοὺς μετὰ τούτους εὔρε τῷ αὐτῷ κανόνι χρησάμενος, ὧ

8 συντιθέντες Höeg (1934) συντεθέντες codd. 15 συντιθεῖσι Höeg (1934) συντεθεῖσι codd.
 18 τό om. G

the numbers 168, 189, 216 and 224 by 3. The numbers produced will be in concord⁶⁷⁵ with these tables.

Tense diatonic		Soft diatonic		Tonic diatonic	
36	504	63	504	168	504
	10:9		8:7		9:8
40	560	72	576	189	567
	9:8		10:9		8:7
45	630	80	640	216	648
	16:15		21:20		28:27
48	672	84	672	224	672

Once these things have been demonstrated, it has been shown which epimoric ratios when put together make up the epitrititic, while being smaller than it and differing from one another | by commensurable excesses. For we have expounded his division into two epimorics and his combination of them, and that into three, from which the smallest of the concords is put together to make the differences of genus and the *chroai* which we interchange in melodies.⁶⁷⁶

Thus the melodic intervals have been assigned, very reasonably,⁶⁷⁷ to the epimorics smaller than the epitrititic, | though not to all of them, only to the ones that are put together to make the epitrititic. These have been appropriately distributed to the melodic intervals that are put together to make the smallest concord, since the smallest concord has been specified as being in epitrititic ratio. Ptolemy found the more melodic of the melodic notes that are put together to make the fourth, and those that come after them,⁶⁷⁸ by the use of the *kanōn* which | he used in the case of the concords,

⁶⁷⁵ Porphyry's term, *sympḥōnos*, 'concordant', is commonly used in non-musical contexts to mean 'in agreement', or as we say 'in harmony' with something else. That is all it means here, but no doubt he intended its musical resonance to be noticed.

⁶⁷⁶ In musical theory the word *chroa*, literally 'colour' or 'shade (of colour)', is primarily an Aristoxenian term (as e.g. at 79.25 above, in a quotation from Aristoxenus). It refers to variants of a genus such as the 'tense' and 'soft' forms of diatonic. Porphyry uses it in this sense only here and in a single paragraph at 157.21–35 below; Ptolemy does not use it at all. The reference to 'interchanging' is probably an allusion to modulation between different *chroai* in the course of a melody; but it might refer merely to changes we may make when we have completed one melody and set out on another.

⁶⁷⁷ This is the usual sense of the adverb *eulogōs*; but Porphyry may mean to imply also that the assignment has been made through the use of reason (*logos*), and it suggests in addition the notion of 'the right ratios (*logoi*)'.

⁶⁷⁸ I.e. those that still qualify as melodic, but to a lesser degree. (The degree of 'melodic-ness' becomes smaller as the relevant epimoric ratios decrease in size, 5:4, 6:5, 7:6 and so on; see Ptol. *Harm.* 16.12–21 and Porphyry's discussion at 117.27–118.15 above.) Earlier in the sentence Porphyry refers to the 'melodic notes'. It would have been more accurate to say 'intervals' or 'ratios' instead of 'notes', but perhaps the expression reflects the emphasis Porphyry has laid on the particular numbers representing notes, in his study of the divisions.

- (20) καὶ ἐπὶ τῶν συμφωνιῶν ἐχρήσατο πρὸς ἀνάκρισιν τῶν συμφωνοτέρων. ἦσαν δὲ συμφωνότατοι οἱ δῖχα ἔγγιστα διαιροῦντες <τὸ διὰ πασῶν>, ὧν συμφωνότερος ὁ ἡμιόλιος, ἅτε δὴ ἔγγιστα ὧν τῆς ἰσότητος.

<“Οἱ δὲ οὐ τὸ εὐλογον ἔχουσι μόνον αἱ προκειμέναι τῶν γενῶν διαι- [5]
ρέσεις, ἀλλὰ καὶ τὸ ταῖς αἰσθήσεσιν σύμφωνον, ἐξέσται πάλιν κατα-
νοεῖν ἀπὸ τοῦ διὰ πασῶν περιέχοντος ὀκταχόρδου κανόνος, ἀκριβου-
μένων τῶν φθόγγων, ὡς εἵπομεν, κατὰ τε τὰς ὁμαλότητας τῶν χορδῶν
καὶ τὰς ἰσοτονίας. ταῖς γὰρ γινομέναις τῶν παρατιθεμένων κανονίων
κατατομαῖς ἀκολουθῶς τοῖς ἐφ’ ἐκάστου γένους λόγοις συναποκαθιστα- [10]
μένων τῶν ὑπαγομένων μαγαδιῶν, οὕτως ἔσται τὸ διὰ πασῶν ἡρμοσμέ-
νον, ὡς μηδ’ ἂν τὸ τυχὸν ἔτι παρακινήσαι τοὺς μουσικωτάτους, ἀλλὰ
θαυμάσαιμεν κὰν τῇ περὶ τὸ ἡρμοσμένον συντάξει τὴν φύσιν, τοῦ μὲν
κατ’ αὐτὴν λόγου πλάττοντος ὥσπερ καὶ διαμορφούντος τὰς σωστικὰς
τοῦ μέλους διαφοράς, τῆς δὲ ἀκοῆς πειθαρχούσης, ὡς ἔνι μάλιστα, τῷ [15]
λόγῳ παρὰ γοῦν τὴν ἐξ αὐτοῦ τάξιν οὕτως διακειμένης καὶ τὸ οἰκεῖον
ἐν ἐκάσταις τῶν προσφύρων ἐπιγινωσκούσης, τῶν δὲ προστάντων τοῦ
τοιούτου μέρους καταγνῶναι, μήτε δι’ αὐτῶν ταῖς εὐλόγοις διαιρέσεσιν
ἐπιβαλεῖν δυνηθέντων, μήτε τὰς ὑπὸ τῆς αἰσθήσεως ἐμφανιζομένας ἀνευ-
ρεῖν ἀξιωσάντων.> [20]

<15>

<[38] Καὶ μέντοι τῶν ἐκτεθειμένων γενῶν τὰ μὲν διατονικὰ παντ’ ἂν
εὐροιμεν συνήθη ταῖς ἀκοαῖς, οὐκέτι δ’ ὁμοίως οὔτε τὸ ἐναρμόνιον, οὔτε
τῶν χρωματικῶν τὸ μαλακόν, ὅτι οὐ πάνυ χαίρουσι τοῖς σφόδρα ἐκλε-
λυμέναις τῶν ἡθῶν, ἀπαρκεῖ δ’ αὐτοῖς ἐν τῇ πρὸς τὸ μαλακόν διαβάσει [5]
μέχρι τοῦ συντόνου χρώματος φθάσαι. Τὸ γὰρ πυκνόν, ὃ διορίζεται
πῶς ἢ τοῦ μαλακοῦ φύσις πρὸς τὴν τοῦ συντόνου, κατὰ τοῦτο περα-
τοῦται τὸ γένος, ἀρχόμενον μὲν ἐντεῦθεν ἐν τῇ πρὸς τὸ μαλακώτερον
ὁδῷ, λήγον δὲ ἐνταῦθα πάλιν ἐν τῇ πρὸς τὸ συντονώτερον. καὶ ἔτι
κατὰ τὴν εἰς δύο λόγους τοῦ ὅλου τετραχόρδου τομὴν τοῖς ἐγγυτάτω [10]
τῆς ἰσότητος καὶ ἐφεξῆς διειληπταὶ λόγοις, τουτέστι τῷ τε ἐπὶ ζ’ καὶ
τῷ ἐπὶ ζ’, δῖχα διαίρουσι τὴν ὅλην τῶν ἄκρων ὑπεροχὴν. αὐτὸ τε οὖν
διὰ τὰ προειρημένα προσφορώτατον φαίνεται ταῖς ἀκοαῖς, καὶ ἕτερον
ἡμῖν ὑποβάλλει γένος ὁρμωμένοις ἀπὸ τῆς παρὰ τὰς ἰσότητος συνι-

21-2 <τὸ διὰ πασῶν> add. Düring διαιροῦντες (lacuna) ὧν συμφωνῶν (lacuna) ὁ ἡμιόλιος g

lemma: Ptol. 37.5-20 addidi

lemma: Ptol. lib. I cap. 16 addidi

to judge those that are more concordant. The most concordant were those that most nearly divide the octave in half, of which the hemiolic is the more concordant, since it is nearest to equality.⁶⁷⁹

<The⁶⁸⁰ fact that the divisions of the genera set out above do not contain only what is rational but also what is concordant with the senses can be grasped, once again, from the eight-stringed *kanōn* that spans an octave, once the notes are made accurate, as we have said, in respect of the evenness of the strings and their equality of pitch. For when the bridges set under <the strings> are aligned with the divisions (those corresponding to the ratios in each genus) marked on the measuring-rods that are placed beside them, the octave will be so tuned that the most musical of men would not alter it any more, even a little. We would be astonished at the nature of the ordering of attunement if on the one hand the faculty of reason that deals with it moulded, as it were, and shaped the differences that preserve melody, and if hearing followed the lead of reason to the greatest degree possible, lying therefore alongside the ordering derived from reason and recognising the appropriateness of each of its propositions, while on the other hand the outstanding experts in the subject condemned it, though they are unable, by themselves, to initiate an investigation of the rational divisions, and neither do they think fit to try to discover those that are revealed by perception.> Ptol. *Harm.* 37.5–20

<Chapter 16⁶⁸¹

Now of the genera that have been set out, we would find all the diatonic ones familiar to our ears, but not to the same extent the enharmonic, nor the soft one of the chromatics, because people do not altogether enjoy those of the characters that are exceedingly slackened, but it is enough for them in the movement towards the soft to stop at the tense chromatic. For the *pyknon*,

⁶⁷⁹ The suggestion that Ptolemy used the monochord, or any such instrument, to judge which melodic intervals are more melodic and which concords are more concordant, has no basis in Ptolemy's text. He makes these judgements on purely 'rational' grounds.

⁶⁸⁰ This final paragraph of Ptolemy's chapter does not appear as a lemma in our MSS, and if Porphyry discussed it his commentary does not survive. At a superficial glance, the preceding paragraph might be taken for such a commentary, but unless Porphyry was being unusually careless he cannot have intended it for that purpose, since it has no real bearing on Ptolemy's remarks. See also the following note.

⁶⁸¹ Our MSS of Porphyry include no commentary on the sixteenth and last chapter of Book I, nor does it appear as a lemma. On this matter and the paragraph missing from I.15 see Introduction pp. 7–8. I print the whole of Ptolemy's chapter here (bracketed to show that it is absent from Porphyry's text), partly for the sake of completeness, but also because Porphyry evidently knew it. Neither *Harm.* II.1 nor Porphyry's discussion of it is intelligible without I.16, and Porphyry refers to it explicitly at 151.5–6. I offer no notes on the passage here; see notes ad loc. in Barker (1989), Solomon (1999), Raffa (2002), and discussions in Hagel (2009; see his Index of Ancient Passages Cited for page references). Cf also Porph. II.1 below with notes.

σταμένης ἐμμελείας καὶ σκοποῦμένοις, εἴ τις ἔσται πρόσφορος σύνταξις [15]
τοῦ διὰ τεσσάρων ἐξαρχῆς εἰς τρεῖς τοὺς παρίσους λόγους διαιρεθέντος
ἐν ἴσαις πάλιν ὑπεροχαῖς. συντιθέασι μὲν γὰρ καὶ τὸ τοιοῦτο γένος ὃ
τε ἐπὶ θ' λόγος καὶ ὃ ἐπὶ ι' καὶ ὃ ἐπὶ ια', τριπλασιασθέντων ὁμοίως τῶν
πρῶτων δεικνύντων ἀριθμῶν τὸν ἐπὶ γ' καὶ ποιησάντων τοὺς μὲν ἐφεξῆς
ἀριθμούς τὸν θ' καὶ τὸν ι' καὶ τὸν ια' καὶ τὸν ιβ', τοὺς δὲ ἐφεξῆς λόγους [20]
τοὺς ἐκκειμένους. προτασσομένων δὲ κἀνταῦθα τῶν μειζόνων λόγων
γίνεται τετράχορδον παρὰ τὸ σύντονον διατονικὸν ὁμαλώτερον ἐκείνου
καὶ καθ' αὐτὸ καὶ ἔτι μᾶλλον ἐπὶ τῆς τοῦ διὰ πέντε συμπληρώσεως. ἡ
γὰρ τῷ ἡγουμένῳ φθόγγῳ συναπτομένη διάζευξις ποιοῦσα λόγον ἐπό-
γδοον οὐκέτι περὶ μόνας τὰς τρεῖς ὑπεροχὰς ἀπεργάζεται τὸ τῆς ἰσότη- [25]
τος ἴδιον, ἀλλὰ καὶ περὶ τὰς τέτταρας περιεχομένης λόγοις τοῖς ἐφεξῆς
ἀπὸ τοῦ ἐπογδόου μέχρι τοῦ ἐπὶ ια'. ποιοῦσι μὲν οὖν τὸ τοιοῦτο διὰ
πασῶν, τῆς διαζεύξεως μέσης τιθεμένης, πρῶτοι τῶν ἀριθμῶν ὁ ιη' καὶ
ὁ κ' καὶ ὁ κβ' καὶ ὁ κδ' καὶ ὁ κζ' καὶ ὁ λ' καὶ ὁ λγ' καὶ ὁ λς'. τῆς δὲ
δι' αὐτῶν κατατομῆς ἐκλαμβανομένης ἐπὶ τῶν ἰσοτονιῶν ξενικώτερον [30]
μὲν πως καὶ ἀγροικότερον ἦθος καταφανήσεται, προσηγνὲς δ' ἄλλως καὶ
μᾶλλον συγγυμναζόμενον ταῖς ἀκοαῖς, ὥς μὴ δεόντως ἂν παροραθῇ
διὰ τε τὸ τοῦ μέλους ἰδιάζον καὶ διὰ τὸ τεταγμένον τῆς κατατομῆς. ἔτι
δὲ ὅτι κἂν καθ' αὐτὸ μελωδῇται, οὐκ ἐμποιεῖ ταῖς αἰσθήσεσι προσκοπῇ,
[39] ὁ μόνω σχεδὸν συμβέβηκε τῷ μέσῳ τῶν διατονικῶν τῶν ἄλλων, καθ'
αὐτὰ μὲν βίᾳ συνηρμοσμένων, ἐν δὲ τῇ πρὸς τὸ εἰρημένον διατονικὸν
μίξει προχωρεῖν δυναμένων, ὅταν τὰ μὲν μαλακώτερα αὐτοῦ κατὰ τὰ
βαρύτερα τῶν διαζεύξεων τετράχορδα λαμβάνηται, τὰ δὲ συντονώτερα
κατὰ τὰ ὀξύτερα. καλεῖσθω μὲν οὖν καὶ τοῦτο τὸ γένος διάτονον [5]
ὁμαλὸν ἀπὸ τοῦ συμβεβηκότος. τῆς δὲ τῶν ἄλλων καὶ συνήθων γενῶν
ἀνακρίσεως ἐκλαμβανομένης τὸ μὲν μέσον καὶ τονιαῖον τῶν διατονικῶν,
ὅταν καθ' αὐτὸ καὶ ἄκρατον ἐξετάζηται, τοῖς τε ἐν τῇ λύρᾳ στερεοῖς
ἐφαρμόσει καὶ τοῖς ἐν κιθάρᾳ κατὰ τὰς τριτῶν καὶ ὑπερτρώπων ἁρ-
μογὰς, τὸ δὲ εἰρημένον τοῦ συντόνου χρωματικοῦ πρὸς αὐτὸ μῖγμα τοῖς [10]
ἐν λύρᾳ μὲν μαλακοῖς, ἐν κιθάρᾳ δὲ τροπικοῖς, τὸ δὲ τοῦ μαλακοῦ δια-
τονικοῦ πρὸς τὸ τονιαῖον μῖγμα ταῖς ἐν κιθάρᾳ παρυπάταις, τὸ δὲ τοῦ
συντόνου διατονικοῦ πρὸς τὸ τονιαῖον μῖγμα τοῖς μεταβολικοῖς ἦθεσιν,
ἃ καλοῦσιν οἱ κιθαρωδοὶ λύδια καὶ ἰάστια, πλὴν καθ' ὅσον ᾄδουσι μὲν
ἀκολούθως τῷ δεδειγμένῳ συντόνῳ διατονικῷ, καθάπερ ἐξέσται σκο- [15]
πεῖν ἀπὸ τῆς τῶν οἰκείων αὐτοῦ λόγων παραβολῆς. ἀρμόζονται δὲ ἕτε-
ρον γένος συνεγγίζον μὲν ἐκείνῳ, πρόχειρον δ' ἄλλως· δύο γὰρ ποιοῦσι
τοὺς ἡγουμένους τόνους καὶ τὸ λοιπόν, ὥς μὲν αὐτοὶ νομίζουσιν, ἡμι-
τόνιον, ὥς δὲ ὁ λόγος ὑποβάλλει, τὸ καλούμενον λεῖμμα. προχωρεῖ δ'
αὐτοῖς τὸ τοιοῦτο διὰ τὸ μηδενὶ ἀξιολόγῳ διαφέρειν μήτε τὸν ἐν τοῖς [20]

by which, in a way, the nature of the soft is distinguished from that of the tense, finds its limit in this genus, beginning from here in the progression towards the softer, and ceasing here again in that towards the more tense. Again, in the division of the tetrachord into two ratios, it is defined by the ratios that are nearest to equality and are consecutive, that is, by the ratios 7:6 and 8:7, which divide in half the difference between the extremes. For the reasons given, then, this genus seems most agreeable to our ears.

It also suggests to us another genus, when we set out from the melodic-ness that is constituted in accordance with equalities, and investigate the question whether there is any appropriate ordering of the tetrachord when it is initially divided into the three nearly equal ratios, again in equal excesses. The ratios comprising this sort of genus are 10:9, 11:10 and 12:11, when we have again tripled in the same way the numbers that first display the ratio 4:3, making the successive numbers 10, 11 and 12, and the successive ratios that have been set out. When here too the greater ratios are put first in order, there arises a tetrachord close to the tense diatonic, and more even than it, both in itself and still more in association with the filling-out of the fifth. For when the <interval of> disjunction, which makes an epogdoic ratio, is conjoined with the leading note, the characteristic of equality is no longer produced only in the three excesses, but in the four that are contained by the successive ratios from the epogdoic to the ratio 12:11. The first numbers that make this kind of octave, when the disjunction is placed in the middle, are 18, 20, 22, 24, 27, 30, 33, 36. When a division is taken on <strings> of equal pitch on the basis of these numbers, the character that becomes apparent is rather foreign and rustic, but exceptionally gentle, and the more so as our hearing becomes trained to it, so that it would not be proper to overlook it, both because of the special character of its melody, and because of the orderliness of the division. Another reason is that when a melody is played in this genus by itself, it gives no offensive shock to the hearing, which is true, pretty well, of only the intermediate one of the other diatonics, the others being attuned by constraint when taken by themselves, but capable of being successful in a mixture with the diatonic just mentioned, when those softer than it are taken in the tetrachords lower than the disjunctions, the tenser in those that are higher. So let us call this genus the 'even diatonic', from the characteristic it has.

When an investigation of the other familiar genera is undertaken, the intermediate or 'tonic' one of the diatonics, when it is examined by itself and unmixed, will fit the *sterea* <played> on the lyre, and on the kithara those corresponding to the attunements of the *tritai* and the *hypertropa*; the mixture of the tense chromatic with it, which has been mentioned, will fit the *malaka* on the lyre and the *tropika* on the kithara; the mixture of soft diatonic with tonic will fit the *parhypatai* on the kithara; the mixture of tense diatonic with the tonic will fit the *metabolika* characters, which the *kitharōidoi* call Lydian and Iastian – except that while they sing in accordance with the tense diatonic that has been set out, as can be seen

ἡγουμένοις τόποις λόγον τὸν ἐπὶ ἡ' τοῦ ἐπὶ θ', μήτε τὸν ἐν τοῖς ἐπομέ-
 νοις τὸν ἐπὶ ιε' τοῦ λείμματος. ἐὰν γὰρ τοῦ οβ' ἀριθμοῦ λάβωμεν τὸν
 τε ἐπὶ θ' καὶ τὸν ἐπὶ η', οὗτος μὲν ποιήσει τὸν τῶν πα', ἐκείνος δὲ τὸν
 τῶν π' καὶ ἔσται ὁ ἐπὶ η' τοῦ ἐπὶ θ' ἐπὶ π'. ὁ αὐτὸς δὲ οὗτός ἐστι
 λόγος καὶ τοῦ διτόνου, τουτέστι τοῦ δις ἐπὶ η' πρὸς τὸν ἐπὶ δ', ὅς ἦν [25]
 ἡγούμενος τοῦ ἐναρμονίου γένους. πρὸς γὰρ τὸν τῶν ξδ' ἀριθμὸν ὁ
 μὲν ἐπὶ δ' πάλιν ποιῇ τὸν π', ὁ δὲ δις ἐπὶ η' τὸν τῶν πα'. ὁμοίως δὲ
 ἐπεὶ λόγος ἐστὶ τοῦ λείμματος ὁ τῶν σνς' πρὸς τὰ σμγ', τούτου δὲ ἐπὶ ιε'
 ὁ τῶν σνθ', ἔσται καὶ τοῦ ἐπὶ ιε' πρὸς τὸ λείμμα λόγος ὁ τῶν σνθ' πρὸς
 [40] τὰ σνς', ὁ δὲ αὐτὸς ἐστὶ πάλιν τῶ ἐπὶ π', τοῦτο δὲ ὅτι καὶ ὁ ἐπὶ δ'
 λόγος ἴσος ἐστὶ συναμφοτέροις τῶ τε ἐπὶ η' καὶ τῶ ἐπὶ θ'. διόπερ ἐν
 οὐδετέρῳ τῶν ἐκκειμένων γενῶν συνίσταται τις ἀξιόλογος προσκοπὴ
 καταχρωμένων αὐτῶν ἐπὶ μὲν τοῦ συντόνου διατονικοῦ τῶ τε ἐπὶ η'
 ἀντὶ τοῦ ἐπὶ θ' κατὰ τὸν ἡγούμενον τόπον καὶ τῶ λείμματι ἀντὶ τοῦ [5]
 ἐπὶ ιε' κατὰ τὸν ἐπόμενον τόπον, ἐπὶ δὲ τοῦ ἐναρμονίου τῶ τε δις ἐπὶ
 η' ἀντὶ τοῦ ἐπὶ δ' κατὰ τὸν ἡγούμενον τόπον καὶ τῶ λείμματι πάλιν
 ἀντὶ τοῦ ἐπὶ ιε' κατὰ συναμφοτέρους τοὺς ἐπομένους λόγους. συνυπο-
 κείσθω δ' οὖν ἡμῖν καὶ τοῦτο τὸ γένος διὰ τε τὸ πρόχειρον τῶν μεταβο-
 λῶν τῶν ἀπὸ τοῦ τονιαίου γένους ἐπὶ τὸ δι' αὐτοῦ μῖγμα καὶ διὰ <τὸ> τὸν [10]
 τοῦ λείμματος λόγον ἔχειν τινὰ οἰκειότητα πρὸς τε τὸ διὰ τεσσάρων καὶ
 τὸν τόνον παρὰ τοὺς ἄλλους τῶν μὴ ἐπιμορίων, ἅτε κατὰ τὸ ἀναγκαῖον
 ἐπηκολουθηκότα τοῖς ἐμπίπτουσιν εἰς τὸν ἐπίτριτον δυσὶν ἐπογδοίσις.
 ἔσται γὰρ πως καὶ τὸ λείμμα καθ' αὐτὸ καὶ διὰ συμφωνίας εἰλημμένον
 ὥσπερ καὶ ὁ τόνος, οὗτος μὲν ἐκ τῆς ὑπεροχῆς τῶν πρώτων δύο συμφω- [15]
 νίων, ἐκείνο δὲ ἐκ τῆς ὑπεροχῆς τοῦ διτόνου παρὰ τὴν διὰ τεσσάρων
 συμφωνίαν. ποιοῦσι μὲν οὖν καὶ τοῦτο τὸ γένος ἀριθμοὶ πρώτοι ὃ τε
 τῶν ρβ' καὶ ὁ τῶν σισ' καὶ ὁ τῶν σμγ' καὶ ὁ τῶν σνς'. κληθεὶς δ'
 ἂν εἰκότως καὶ αὐτὸ διτονισαῖον, ὅτι τοὺς ἡγουμένους δύο λόγους ἔχει
 τονιαίους. [20]

διάτονον ὁμαλόν	διάτονον διτονισαῖον
ιη'	ρβ'
ἐπὶ θ	ἐπὶ η'
κ'	σις'
ἐπὶ ι'	ἐπὶ η'
κβ'	σμγ'
ἐπὶ ια'	λείμμα
κδ'	σνς' >

from a comparison with the ratios proper to that genus, they actually tune to another genus, close to that one, but plainly different; for they make the two leading intervals tones, and the remainder, as they think, a half-tone, but as reason infers, what is called the *leimma* [256:243]. This works for them well enough, since there is no noticeable difference either between the ratios 9:8 and 10:9 in the leading positions, or between the ratio 16:15 and the *leimma* in the 'following' positions. For if we take numbers standing to 72 in the ratios 10:9 and 9:8, the latter will make 81 and the former 80; and the ratio 9:8 will be in the ratio 81:80 to the ratio 10:9. This is also the ratio between the ditone – that is, the ratio 9:8 taken twice – and the ratio 5:4, which was the leading ratio of the enharmonic genus. For the ratio 5:4 applied to the number 64 makes 80 again, while the ratio 9:8 taken twice makes 81. Similarly, since the ratio of the *leimma* is 256:243, while the number standing to 243 in the ratio 16:15 is 259, the ratio in which the ratio 16:15 stands to the *leimma* will be that of 259 to 256. This is again the same ratio as 81:80, and that is because the ratio 5:4 is equal to the ratios 9:8 and 10:9 taken together. For this reason, in neither of the genera set out does any noticeable offence arise, when in the tense diatonic they wrongly use the ratio 9:8 instead of 10:9 in the leading position and the *leimma* instead of the ratio 16:15 in the 'following' position, and when in the enharmonic they use the ratio 9:8 taken twice instead of the ratio 5:4 in the leading position, and the *leimma* once again instead of the ratio 16:15 for the two 'following' ratios taken together.

Let us then accept this genus too, both because of the ease of the modulations to it from the tonic diatonic genus, in the case of the mixture with this one, and also because the ratio of the *leimma* has a certain affinity with the fourth and the tone, marking it out from the other ratios that are not epimoric, since it follows inevitably when two epogdoics have been inserted into the epitritie. For the *leimma*, too, can be constructed by itself by means of concords, just as can the tone, the latter from the difference between the first two concords, the former from the difference between a ditone and the concord of a fourth. The first numbers that make this genus are 192, 216, 243, 256. It may reasonably be called 'ditonic', since it has tones as its two leading ratios.

Even diatonic	Ditonic diatonic
18	192
10:9	9:8
20	216
11:10	9:8
22	243
12:11	<i>leimma</i>
24	256 >

α'

- (151) [42] Λάβοιμεν δ' ἂν καὶ καθ' ἕτερον τρόπον τὰς αὐτὰς συμμετρίας τῶν συνήθων καὶ εὐμεταχειρίστων ταῖς ἀκοαῖς γενῶν, οὐχ ὥσπερ νῦν ἀπὸ μόνου τοῦ εὐλόγου γεννῶντες αὐτῶν τὰς διαφοράς, ἔπειτα προσάγοντες διὰ τοῦ κανόνος ταῖς ἀπὸ τῶν φαινομένων μαρτυρίας, ἀλλὰ ἀνάπαλιν πρότερον ἐκτιθέμενοι τὰς διὰ μόνης τῆς αἰσθήσεως συνισταμένας ἀρμο- [5] γάς, ἔπειτα δεικνύντες ἀπ' αὐτῶν τοὺς ἀκολουθοῦς λόγους ταῖς καταλαμβανομέναις ἐφ' ἑκάστου γένους τῶν φθόγγων ἰσότησιν ἢ ὑπεροχαῖς. ὑποτιθέμεθα δὲ κἀνταῦθα μόνα τῶν παρὰ πᾶσιν ἀπλῶς ὡμολογημένων τὸ τὴν μὲν διὰ τεσσάρων συμφωνίαν ἐπίτριτον περιέχειν λόγον, τὸν δὲ τόνον ἐπόγδοον. [10]
- (5) Πρότερον μὲν ὁ Πτολεμαῖος τὰ συνηθέστερα γένη τοῦ ἡρμοσμένου ἐκ τοῦ λόγου δεικνὺς παρέπεμπε ταῖς αἰσθήσεσι, νῦν δ' ἀντιστρόφως ἀπὸ τῆς αἰσθήσεως τὰς διαφοράς τῶν γενῶν διὰ μόνης τῆς αἰσθήσεως συνιστᾶν βούλεται ἐκ τῶν κιθαρικῶν νόμων, ἔπειτ' ἀπ' αὐτῶν παραπέμπειν τὰς ἀρμογὰς τοῖς ἀκολουθοῦσι λόγοις. καὶ γὰρ οὐθ' ὁ λόγος καθ' αὐτὸν χωρὶς αἰσθήσεως οἷός τε ποτ' ἐστὶ τὸ τοιοῦτον ἡρμοσμένον συστήσασθαι, οὔτε μὴν πάλιν ἡ αἰσθησις καθ' αὐτὴν χωρὶς λόγου, ἀλλ' ὁ μὲν λόγος διὰ τῆς αἰσθήσεως, ἡ δ' αἰσθησις διὰ τοῦ λόγου· ἢ μᾶλλον εἰπεῖν
- (10)

1 ἐξήγησις τοῦ δευτέρου βιβλίου εἰς τὸ λάβοιμεν δ' ἂν G πορφυρίου ὑπόμνημα εἰς τὸ δεύτερον τῶν πτολεμαίου ἀρμονικῶν οὗ ἡ ἀρχὴ p

BOOK II

Chapter I

There is also another way in which we can find the same sets of proportions, those of the genera that are familiar and readily accepted by the ear, not generating their differences from what is rational alone, as we did just now, and then submitting them by means of the *kanōn* to evidence drawn from what is perceived, but reversing the procedure, first setting out the attunements put together through perception alone, and then showing from them the ratios that go with the equalities and differences between the notes that are adopted in each genus. We shall assume here too only those things that are straightforwardly agreed by everyone, that the concord of the fourth bounds an epitritus ratio, and that the tone bounds one that is epogdoic. Ptol. *Harm.* 42.1–10

[151D]

| Ptolemy⁶⁸² has previously demonstrated the more familiar genera of attunement by means of reason, and has then passed them on to the senses; but now, conversely, he wants to construct the differences between the genera from a starting-point in sense-perception, through perception alone, on the basis of the kitharic *nomoi*,⁶⁸³ and then to pass the attunements on from the senses to the logical processes of reason.⁶⁸⁴ For neither reason by | itself without perception nor perception by itself without reason can establish an attunement of this sort, but reason can do so through perception and perception through reason; or rather, reason can do it

⁶⁸² Stefan Hagel and Massimo Raffa have read a draft of my translation of this perplexing chapter and my footnotes on it. They have made valuable suggestions for which I am very grateful, and have made me think again about several passages. But all three of us still have different views on various issues, and neither Hagel nor Raffa should be held responsible for deficiencies in my interpretation of the text or in the comments I make about it.

⁶⁸³ In musical contexts a *nomos* can be a composition of any sort, but from the fourth century BC onwards the word was usually reserved for the elaborate works performed by professional soloists, especially at competitive festivals. It is hard to see how that usage could make sense here. *Nomos* also has the non-musical sense 'law' or 'custom', so that the allusion here might be to the 'customary practices' of kithara-players (cf. e.g. 152.31 below); this seems an unnatural interpretation of the expression in a musical environment, but I can think of nothing better. The adjective with which Porphyry qualifies it, *kitharikos* ('kitharic'), is very rare; it appears elsewhere only in a schol. on Clem. Alex., in an alchemical text of the seventh to eighth century AD, and in a text on jurisprudence compiled between the ninth century and the thirteenth. Unless it is a copyist's error or a mistaken correction, Porphyry may have used (or coined) it here to avoid the specificity of the usual adjectives *kitharistikos* (referring to music for kithara alone, without singing) and *kitharōidikos* (referring to singing accompanied by the kithara). But in the rest of the chapter he follows Ptolemy in referring to the attunements of the *kitharōidoi*.

⁶⁸⁴ More literally, 'to the reasonings that follow', i.e. those that follow a logical chain of inference. Here, as often, the ambiguity between *logos* as 'reason' and as 'ratio' is in play, and it is indeed the ratios that will be worked out by reason from the perceptual data; but at this stage the focus is on the contrast between sense-perception and reason.

- λόγος μόνος τῇ αἰσθήσει ὑπηρέτιδι χρώμενος. καὶ γὰρ οὗτός ἐστιν ἀληθῶς, δις συνίστησι μὲν καθ' αὐτὸν τὸ ἡρμοσμένον, κρίνει δὲ διὰ τῆς
- (15) αἰσθήσεως, πρὸς ἣν καὶ συντάττειν αὐτὸ αἰεὶ εἴωθεν, εἴτε καλῶς τοῦτο ἡρμοσται παρ' αὐτοῦ, εἴτε μή. δεῖ δ' εἰδέναι, ὅτι ἐν τῷ τετραχόρδῳ, ὃ δὴ ἐν λόγῳ ἐπιτρίτῳ συνίσταται, οἱ μὲν ἄκροι ἐστῶτές εἰσι· λόγον γὰρ αἰεὶ ποτ' ἐπίτритον ἔχουσιν· οἱ δὲ μέσοι κατὰ τὰ γένη τῆς ἀρμονίας κινουῦνται. ἐπεὶ γὰρ ὁ ἐπίτритος ἐκ τῶν ἐπιμορίων συνίσταται διαφόρων,
- (20) καὶ τρία ἔχει τὸ τετράχορδον διαστήματα, διάφοροι [γὰρ] ἐπιμόριοι λόγοι τρεῖς τὸν ἐπίτритον λόγον συνιστῶσιν· ὥς οἱ μβ' μη' νβ'. ὁ γὰρ νς' τοῦ μβ' ἐπὶ γ', τοῦ δὲ νβ' ἐπὶ ιγ' καὶ οὗτος αὐθις τοῦ μη' ἐπὶ ιβ' καὶ οὗτος τοῦ μβ' ἐπὶ ζ' καὶ σύγκειται ἐξ ἐπὶ ιγ' ἐπὶ ιβ' καὶ ἐπὶ ζ'.
- Καὶ αὐθις ἄλλος ἐπὶ γ' ἐξ ἐπὶ θ' καὶ ἐπὶ η' καὶ ἐπὶ ιε' ὥς ἐπὶ τοῦ κ' ιη' ις' ιε', καὶ ἐξ ἐπὶ ιγ' καὶ ἐπὶ ιβ' καὶ ἐπὶ ζ' ὥς ἐπὶ τοῦ κη' κς' κδ' κα', καὶ ἐξ ἐπὶ ιε' καὶ ἐπὶ ιδ' καὶ ἐπὶ ζ' ὥς ἐπὶ τοῦ λβ' λ' κη' κδ', καὶ ἐξ ἄλλων μυρίων, ἵνα μὴ καθ' ἕκαστον λέγω. τὸ μὲν πάντας παραλαμβάνειν εἰς τὴν τοῦ ἡρμοσμένου σύστασιν λόγος φύσεως ἀπεκώλυνσε.
- (152) Φησὶ γὰρ καὶ ὁ Ἀριστοτέλης ἐν τῷ Περὶ αἰσθήσεως καὶ αἰσθητῶν λέγων περὶ χρωμάτων, ὅτι “τὸν αὐτὸν δὴ τρόπον ἔχει ταῦτα ταῖς συμφωνίαις· τὰ μὲν γὰρ ἐν ἀριθμοῖς εὐλογίστοις χρώματα, καθάπερ ἐκεῖ τὰς συμφωνίας, ἥδιστα τῶν χρωμάτων εἶναι δοκεῖ, οἷον
- (5) τὸ ἀλουργὸν καὶ φοινικοῦν καὶ ὀλίγ' ἄττα τοιαῦτα, δι' ἣν αἰτίαν καὶ αἱ συμφωνίαι ὀλίγαι.”

20 [γὰρ] secludendum Hagel per litteras
id' codd.

22 ἐπὶ ιγ' Wallis ἐπὶ ιδ' codd.
24 ἐπὶ η' Alexanderson ἐπὶ ιη' typographico errore Düring

23 ἐπὶ ιγ' Wallis ἐπὶ

alone, using perception as its maid-servant. For indeed it is really reason that establishes by itself what is attuned, but it judges it through | perception, to which it always refers it to find out whether it has attuned it well or not.⁶⁸⁵

One must understand that in the tetrachord, which is constructed in epitritric ratio, the extreme terms are stationary, since they are always related in epitritric ratio, but that the intermediate notes move in correspondence with the genera of attunement. For the epitritric is composed from epimorics in various ways. | The tetrachord has three intervals, and three different epimoric ratios compose the epitritric, for instance <in the numbers> 42, 48, 52, 56. For 56 is in the ratio 4:3 to 42 and in the ratio 14:13 to 52, which in its turn is in the ratio 13:12 to 48, and the latter is in the ratio 8:7 to 42. It is composed from 14:13, 13:12 and 8:7. Again, there are other epitritrics composed from 10:9, 9:8 and 16:15, as in the numbers 20, | 18, 16, 15; from 14:13, 13:12 and 8:7, as in the numbers 28, 26, 24, 21; from 16:15, 15:14 and 7:6, as in the numbers 32, 30, 28, 24; and from a great many others, to avoid specifying them all individually.⁶⁸⁶

Now the reason (*logos*) that is inherent in nature⁶⁸⁷ prevents us from adopting all of them into the constitution of attunement. For Aristotle says in his *On sense-perception and perceptibles*, when speaking about colours: 'They are in the same situation as the concords; for the colours that are in numbers with good ratios, like the concords in the other case, seem to be the pleasantest of the colours – | purple and crimson, for example, and a few others of that sort; and the concords are few for the same reason.'⁶⁸⁸

[152D]

⁶⁸⁵ Porphyry has returned to the epistemological issues that occupied him in his discussion of *Harm.* I.1, especially at 11.1–19.19. For the thesis that reason is the sole judge, but that it judges 'with the help of' or 'by means of' perception, see 19.15–19; and for statements comparable to this and to others that Porphyry makes here, see e.g. Ptol. *Harm.* 93.11–94.20, *De criterio* 8.3–4, 10.1–5. The subject of 'it has attuned it' at the end of the sentence is 'reason', not 'perception'.

⁶⁸⁶ Of the combinations listed, only 10:9, 9:8, 16:15 appears in any of Ptolemy's attunements (as the tense diatonic). But Porphyry does not mean them all to be understood as musically acceptable divisions, as his next sentence shows; he presents them in order to demonstrate that additional principles must be brought into play if the mathematical possibilities are to be restricted to those that are harmonically admissible. All those he mentions here can be constructed by first dividing the epitritric, as Ptolemy does, into two epimorics, e.g. in the last example, 8:7 and 7:6; then keeping one of them (e.g. 7:6) intact, again as Ptolemy does; and finally dividing the other by first multiplying the terms of the ratio by 2 instead of by Ptolemy's 3 (e.g. 8:7 = 16:14), and inserting the intermediate term (in this case 15, producing the ratios 16:15 and 15:14). Eratosthenes and Didymus seem to have followed this procedure in some though not all of their divisions; see the tables in Ptol. *Harm.* II.14.

⁶⁸⁷ Cf. 12.10–28 above.

⁶⁸⁸ Aristotle *De sensu* 439b–440a.

- Αἱ γὰρ ἐν ἀριθμοῖς εὐλογίστοις συνιστάμεναι ἡδεῖαί εἰσι καὶ ταῖς ἀκοαῖς εὐφοροί, αἱ δ' ἐν τοῖς ἀλογίστοις συγκεχυμέναι καὶ ἀλογοί. ὥστε μόνοι οἱ ἰε' παρελήφθησαν εἰς συμπλήρωσιν τοῦ ἐπὶ γ', ὁ ἐπὶ δ', ὁ ἐπὶ ε' (10) ὁ ἐπὶ ζ', ὁ ἐπὶ ζ', ὁ ἐπὶ η', ὁ ἐπὶ θ', ὁ ἐπὶ ι', ὁ ἐπὶ ια', ὁ ἐπὶ ιδ', ὁ ἐπὶ ιε', ὁ ἐπὶ κ', ὁ ἐπὶ κα', ὁ ἐπὶ κγ', ὁ ἐπὶ κζ' καὶ ὁ ἐπὶ με'. ἐκ τούτων οὖν τρεῖς ἀποτελοῦσι τὸν <ἐπί> γ' ἢ καὶ δύο, ἐξ ὧν τούτων τῶν δύο ὁ εἰς εἰς δύο πρῶτους ἀναλύεται· καὶ εἰ μὲν συντεθέντες οἱ δύο κατὰ τὸν ἐπόμενον τόπον ἐλάττους τοῦ ἐνός εἰσι τοῦ κατὰ τὸν ἡγούμενον, πυ- (15) κνὸν τὸ σύστημα λέγεται, εἰ δ' οὐ, ἄπυκνον. δεῖ δ' εἰδέναι, ὥς οὐδὲν ἄλλως αἰσθανόμεθα τὰς τῶν φθόγγων πρὸς ἀλλήλους διαφοράς, ἐξ ὧν τὸ σύστημα, εἰ μὴ ἐκ τῆς κατατομῆς τῆς διὰ τοῦ ὀξυκέντρου καρκίνου. οὐδὲ γὰρ δυνάμεθα ἐπέκεινα τοῦ ἐπὶ γ' διαισθανθῆναι ἄλλως διαφορὰν φθόγγου πρὸς φθόγγον· παχυμερῶς γὰρ αἰσθήσεις ἀντιλαμβάνονται· (20) καὶ πῶς ἂν ἐπὶ δ' ἢ ἐπὶ ε' ἢ ἐπὶ κ' ἀντιλήψονται; κάτωθεν δὲ τοῦ ἐπὶ γ'

12 <ἐπί> add. Düring

13 συντεθέντες Alexanderson συντιθέντες codd.

Those that are constituted in numbers with good ratios are pleasant and readily accepted by the hearing, but those that are in numbers with no ratio are confused and irrational.⁶⁸⁹ Hence only fifteen ratios are adopted for filling out the ratio 4:3; they are 5:4, 6:5, | 7:6, 8:7, 9:8, 10:9, 11:10, 12:11, 15:14, 16:15, 21:20, 22:21, 24:23, 28:27 and 46:45.⁶⁹⁰ Three of these will produce the epitritie, or indeed two will do so, when one of the two is divided into two primary ratios. And if, when we have put these two in the 'following' position, they are smaller than the one in the leading position, | the system is described as *pyknos* ('compressed'), while if they are not it is called *apyknos* ('not compressed'). It must be understood that we cannot perceive the relative differences between the notes from which the system is constructed in any other way than through the division made by a sharp-pointed pair of compasses;⁶⁹¹ for when we proceed beyond the epitritie,⁶⁹² there is no other way in which we can accurately perceive the difference between note and note, since our senses grasp things only approximately. | How then can the ratios 5:4 or 6:5 or 21:20 be grasped? But

⁶⁸⁹ The subject of the sentence must grammatically be 'those concords', but Porphyry (unlike Aristotle) is thinking of melodic intervals too. 'In numbers with good ratios', here and in the quotation above, translates *en arithmois eulogistois*, 'in well-ratioed numbers'. 'In numbers with no ratio' is a literal rendering of *en arithmois alogistois*; and 'irrational' represents *alogoi* ('having no ratio'). But again, Porphyry is not primarily concerned with relations that are 'irrational' in the sense that they cannot be represented as ratios of integers (e.g. the ratio between the square roots of 4 and of 3, which would exactly halve the epitritie), but with all those that are outlawed from music by the 'reason inherent in nature'. The passage of the *De sensu* from which Porphyry's quotation is taken (439b26–440a6) seems also to hesitate between the contrasts 'good ratio / irrational' and 'good ratio / bad ratio'. Aristotle does nothing to explain what makes a ratio 'good' or 'bad'; if challenged, he would probably have subscribed to the restriction of 'good' ratios to multiples and epimorics, but he may not have known any principles by which the restriction could be justified and by which the number of such ratios could be suitably limited. Cf. Barker (2007): 338–48.

⁶⁹⁰ These are the ratios used by Ptolemy in his divisions of the tetrachords in *Harm.* I.15, and Porphyry is clearly thinking of the reasoning by which he restricts them to the fifteen listed here. The word 'hence' (*hōste*) at the beginning of the sentence suggests that his preceding remarks provide adequate grounds for the restriction, but they will do so only if supplemented by Ptolemy's requirement that the tetrachord's three ratios be found by first dividing 4:3 into two epimoric sub-ratios and then dividing one of them into two. Porphyry's previous statements elide this point, though he is evidently referring to it in the next sentence.

⁶⁹¹ Though I have found no ancient writer who says so explicitly, the compasses must have been used to measure and mark the positions of notes on the measuring-rod (*kanonion*) laid alongside or under the string of a monochord or similar instrument. See Creese (2010): 41–2.

⁶⁹² That is, when we are dealing with intervals smaller than the fourth, whose ratios are 'beyond' 4:3 in the sense that their terms are larger. This is an unusually pessimistic view of the ear's powers of discrimination; cf. Hagel (2010): 206–7, who notes, courtesy of an anonymous reviewer, that it may be a reminiscence of Aristox. *El. harm.* 55.3–12. Porphyry may also have had in mind Ptolemy's remarks at *Harm.* 4.19–5.10.

ὥς ἐπὶ τοῦ ἡμιολίου καὶ τοῦ διπλασίου αἰσθανθήσονται, πλὴν οὐδὲ τούτων ἐπ' ἄπειρον, ἀλλὰ μέχρι καὶ τετραπλασίου δύναται προχωρεῖν ἡ φωνῆς πρὸς φωνήν, ἡ φθόγγου πρὸς φθόγγον διαφορά· ἐπέκεινα δ' οὐ πέφυκεν, εἰ μὴ μέλλοι ἢ μὲν ὀξύτατη διαρραγήσεσθαι, ἢ δὲ βαρυτάτη

(25) ἄφωνος διὰ τὴν πολλὴν ἄνεσιν γενήσεσθαι.

Πρῶτον οὖν ὁ Πτολεμαῖος ἐκτίθησιν ἐν ἐνὶ τετραχόρδῳ τῆς κιθάρας τὴν ὑπὸ τοῦ λόγου συνισταμένην ἐκάστου γένους ἁρμογῆν, εἴτα τηρεῖ μὲν ἓνα φθόγγον ἀκίνητον, μεταφέρει δὲ τοὺς λοιπούς ὅπῃ ἂν γε καὶ τύχῃ, ἡ ἐπὶ τὸ ὀξύ, ἡ ἐπὶ τὸ βαρύ, ἡ ἐπ' ἀμφοτέρα, ὥστε τὸ μέλος ὅλον

(30) ἀνάρμοστον γενέσθαι· εἴτα πρὸς τὸν ἀκίνητον φθόγγον συνίστησι πάλιν διὰ μόνης τῆς αἰσθήσεως κατὰ τοὺς κιθαρωδοὺς ὁμοίως ἐκάστου γένους ἁρμογῆν, καὶ δείκνυσιν ἑναργῶς ἐντεῦθεν, ποῖοι μὲν λόγοι κατ' ἀμφοτέρας τὰς εἰρημένας τοιαύτας ἁρμογὰς τοῦ αὐτοῦ καὶ ἐνὸς γένους ἴσοι εἰσίν, ποῖοι δ' ὑπερέχοντες καὶ ἐλλείποντες. καὶ οὕτως ἐπανορθοῖ καὶ

(35) συνίστησι τὸ καλῶς ἡρμοσμένον.

below the epitritie,⁶⁹³ as in the cases of the hemiolic and the double, they will be perceived, though not without limit; the difference between voice and voice or note and note can proceed only as far as the quadruple. It is not equipped by nature to go beyond that, if the highest is not to crack or the lowest | to become voiceless because of its extreme relaxation.⁶⁹⁴

First, then, Ptolemy sets out, in one tetrachord on the kithara, the attunement of each genus that has been constructed by reason.⁶⁹⁵ He then keeps one note unchanged and moves the remaining ones in whatever direction it may be, upwards or downwards or both, so that the melody as a whole | becomes un-attuned.⁶⁹⁶ Then he constructs on the unchanged note⁶⁹⁷ the attunement of each genus again in the same way, through perception alone by the method of the *kitharōidoi*, and from this he demonstrates clearly which ratios in each of the two attunements of one and the same genus are equal, and which are greater or smaller.⁶⁹⁸ In this way he establishes correctly and | constructs that which is well attuned.⁶⁹⁹

⁶⁹³ Porphyry is referring to the ratios of the concords. (He ignores the octave plus fourth, whose ratio (8:3) does not fall within the sequence of multiple and epimoric ratios constructed in *Harm.* I.7, which Porphyry evidently has in mind.) In describing them as 'below (*katōthen*) the epitritie', he evidently intends a contrast with those 'beyond (*epekeina*) the epitritie', but this way of expressing it is strange. The main problem is not that the epitritie is itself the ratio of a concord, but that the sense in which the ratios of the other concords are 'below' it is unexplained. Perhaps he means that the sum of the terms of each of them is smaller than the sum of 4 and 3; this would make sense, and the corresponding sum for each of the ratios which are said to be 'beyond' the epitritie will of course be greater. But it would be a very obscure way of putting the idea.

⁶⁹⁴ These remarks about the limits of the voice's range seem beside the point. We would have expected a statement about the range within which the ear can identify such intervals accurately.

⁶⁹⁵ This way of putting the point is potentially misleading, though not actually false. The attunements in question are not those worked out by reason in *Harm.* I.15, but the adjusted versions attributed to practising musicians in I.16. Nor are the attunements made here on the basis of the ratios that reason has excogitated; they are attuned by ear alone, and Ptolemy will go on to explain how the ratios of the intervals of these audible systems can then be demonstrated.

⁶⁹⁶ Porphyry seems to mean that a system composed from all the notes that have now been put in place will be musically unacceptable, which is true but irrelevant.

⁶⁹⁷ That is, he uses a note in the first attunement as one of the notes of the attunement which is now to be constructed.

⁶⁹⁸ Although Ptolemy's first construction (see the next lemma) is indeed designed to establish ratios for tetrachords in one particular genus, this is not his main purpose in this chapter, as Porphyry seems to recognise in his opening remarks. But it reappears repeatedly in Porphyry's discussion; cf. also 153.23–5 with nn. 706–7.

⁶⁹⁹ This is a vague and confusing account of Ptolemy's procedure. In particular, it unambiguously implies ('first . . . then . . . then') that there are three stages: first, setting up the original attunement; then keeping one note unchanged and moving the others up or down or both; and finally transposing the initial attunement to a different pitch (or constructing a different attunement) while keeping the unchanged note as one of its constituents. In fact only the first and last of these steps are involved, as will be seen in the next quotations from Ptolemy; the second looks like a clumsy attempt at describing the third in a different way, though this is inconsistent with the indications of a three-part sequence of steps. Stefan Hagel has suggested (in correspondence) that Porphyry is thinking of a procedure using only four strings on an instrument allied to the monochord, that the bridge positions for the first attunement were measured and recorded, and that three of the bridges had then to be removed or shifted to random positions before the final

- (153) τῶν δὴ παρὰ τοῖς κιθαρωδοῖς μελωδουμένων τετρα- [10]
 χόρδων πεποιήσθω πρῶτον τὸ ἀπὸ νήτης μέχρι παραμέσης διὰ τεσσάρων
 τῶν καλουμένων τρόπων ὡς τὸ ΑΒΓΔ, τοῦ Α κατὰ τὴν νήτην τασσομένου.

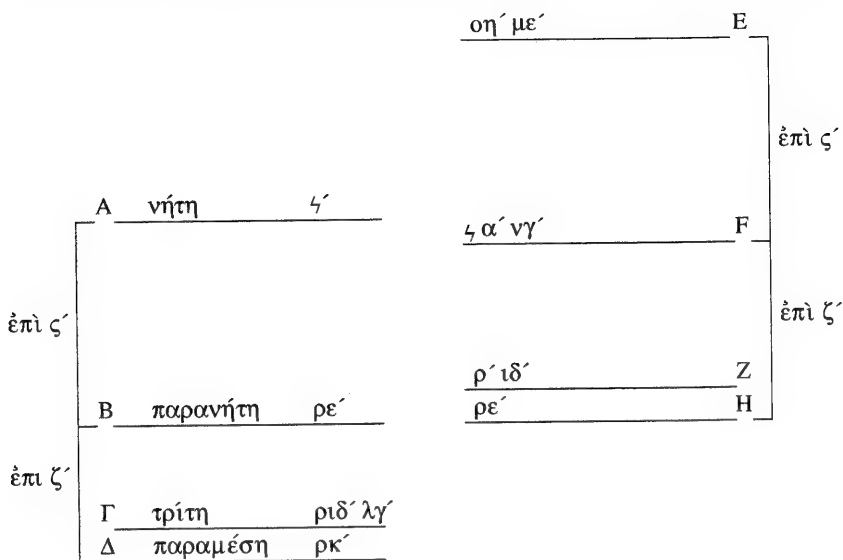


Figure 5G

λέγω ὅτι περιέχεται ὑπ' αὐτοῦ τὸ τοῦ ἐκτεθειμένου συντόνου χρώματος
 γένος, καὶ πρῶτον ὅτι ὁ μὲν τῶν ΑΒ λόγος ἐπὶ ζ' ἐστίν, ὁ δὲ τῶν
 ΒΔ ἐπὶ ζ'· ὁ γὰρ τῶν ΒΓ καὶ ΓΔ μετὰ ταῦτα δειχθήσονται. εὔρε- [15]
 θήσονται τοίνυν μείζον τόνου ποιοῦντες μέγεθος ἐκάτεροι οἱ τε ΑΒ καὶ
 ΒΔ, τουτέστι μείζονα τοῦ ἐπὶ η' λόγου, καὶ ἔστιν ὁ τῶν ΑΔ ἐπὶ γ'·
 [43] ἄλλοι τε δύο λόγοι μείζονες τοῦ ἐπὶ η' τὸν ἐπὶ γ' οὐ συμπληροῦσιν εἰ
 μὴ ὁ ἐπὶ ζ' καὶ ὁ ἐπὶ ζ', ὥστε καὶ τῶν ΑΒ καὶ ΒΔ λόγων ὁ μὲν ἕτερος
 ἔσται ἐπὶ ζ', ὁ δὲ ἕτερος ἐπὶ ζ'. εἰλήφθω δὴ τῶ Β ισότονος ὁ Η καὶ
 πεποιήσθω ἀπ' αὐτοῦ ἐπὶ τὸ ὀξύτερον τετράχορδον ὁμοιον τῶ ΑΒΓΔ τὸ
 ΕFΖΗ. εὔρεθήσεται τοίνυν ὁ Α τοῦ F ὀξύτερος-ισότονοι δὲ οἱ ΒΗ- [5]
 μείζων ἔστιν ἄρα καὶ ὁ τῶν ΑΒ λόγος τοῦ τῶν FH, ἀλλ' ὁ τῶν FH ὁ
 αὐτὸς ὑπόκειται τῶ τῶν ΒΔ. μείζων ἔστιν ἄρα καὶ ὁ τῶν ΑΒ λόγος
 τοῦ τῶν ΒΔ. ὁ μὲν τῶν ΑΒ ἄρα ἔσται ἐπὶ ζ', ὁ δὲ τῶν ΒΔ ἐπὶ ζ'.

- (2) Ἡ μὲν ἀκρίβεια ἀπαιτεῖ, ἵνα τριῶν ὄντων λόγων καὶ διαστημάτων ἐν
 τετραχόρδῳ τὸ μὲν μέγιστον ἐν τῶ ἡγουμένῳ ᾗ, τὸ δὲ μείζον ἐν τῶ
 μέσῳ, τὸ δ' ἑλαττον ἐν τῶ ἐπομένῳ, ὥστε καὶ ἐνταῦθα, τοῦ ἐπὶ ζ' ἐν τῶ

Of the tetrachords played by the *kitharōidoi* let there be constructed, first, the fourth from *nētē* to *paramesē* belonging to what is called the *tropoi*. Let this be ABCD, with A assigned to *nētē*. [153D]

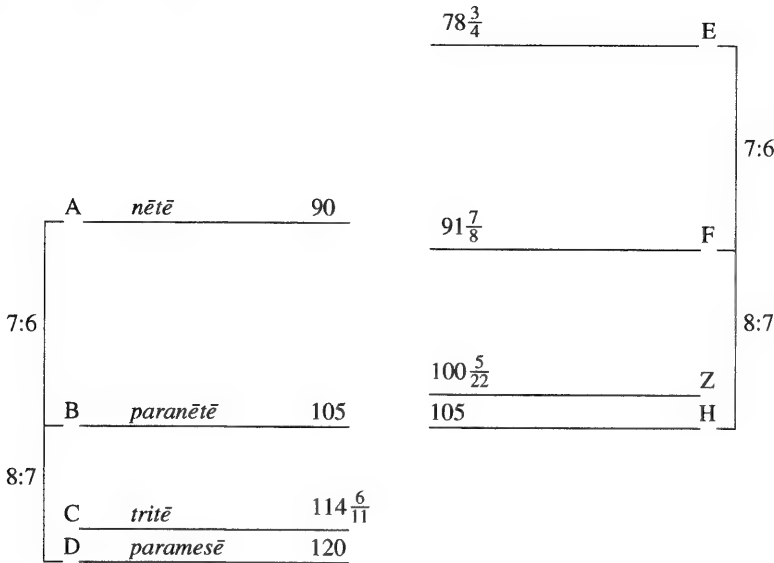


Figure 5

I say that what this contains is the genus of the tense chromatic that has been set out, and first that the ratio of AB is 7:6, while that of BD is 8:7. Those of BC and CD will be shown later. Now each of AB and BD will be found to make a magnitude greater than a tone, that is, greater than the ratio 9:8, and the ratio of AD is 4:3; and no two ratios greater than 9:8 fill out the epitritie except 7:6 and 8:7. Next let there be taken the note H, equal in pitch to B, and let there be constructed upwards from it the tetrachord EFZH, similar to ABCD. Now A will be found to be higher than F, when B and H are of equal pitch, and hence the ratio of AB is greater than that of FH, while it was laid down that the ratio of FH is the same as that of BD. Hence the ratio of AB is greater than that of BD, and hence that of AB will be 7:6, while that of BD will be 8:7. Ptol. *Harm.* 42.10–43.8

Accuracy demands that of the three ratios and intervals which there are in the tetrachord, the greatest should be in the leading position, the greater

attunement was set up, to avoid illicit inferences from visible relations between their positions in the first attunement and the last. This would correspond to Porphyry's second step. But though this interpretation makes sense of the text, I do not see how a reader could be expected to reach it unaided; nor do I find any indication in Porphyry or Ptolemy that the procedure required the use of a 'scientific' instrument (still less one specifically restricted to four strings). On the contrary, part of the point is that Ptolemy's conclusions can be reached without 'rational' devices of this sort.

- (5) ἡγουμένῳ κειμένῳ, τοῦ ἐνὸς ἐπὶ ζ' διαλυομένου εἰς δύο λόγους τὸν τ' ἐπὶ ια' καὶ τὸν ἐπὶ κα', τὸν μὲν ἐπὶ ια' προηγέσθαι, τὸν δ' ἐπὶ κα' ἔπεσθαι. ἀλλ' ἐπεὶ οὕτω κειμένων συγχέονται οἱ ἀριθμοί, καὶ λεπτῶν καὶ πρώτων καὶ δευτέρων καὶ τρίτων δεόμεθα, αὐτὸν δὴ τὸν ἐπὶ ζ' διαλύομεν εἰς ἐπὶ κα' καὶ ἐπὶ ια' μόνον λογιζόμενον καὶ ἔξω τοῦ τετραχόρδου.
- (10) καὶ οὕτως ἐν τῷ τετραχόρδῳ κεῖται πρῶτος ἐν τῷ μέσῳ ὁ <ἐπὶ> κα', ἐν δέ γε τῷ ἐπομένῳ ὁ ἐπὶ ια' καὶ μένουσι καὶ οἱ ἀριθμοὶ ἀσύγχυτοι, ἡ γὰρ καὶ ρε', ὧν ἡ ὑπεροχὴ τὸ ἕκτον ιε'. εἴτα ρί', ὧν ἡ ὑπεροχὴ τὸ εἰκοστόπρωτον πρὸς τὰ ρε' ε'. εἴτα ρκ', ὧν ἡ ὑπεροχὴ τὸ ἐνδέκατον πρὸς τὰ ρί' ι'. καὶ οὕτω γίνεται τὸ πυκνὸν χρωματικὸν σύντονον ἐν τῷ
- (15) πρώτῳ τμήματι τοῦ α' κεφαλαίου τοῦ δευτέρου βιβλίου. ἐν τούτῳ γὰρ ἐκτίθησιν ὁ Πτολεμαῖος κατὰ τοὺς κιθαρῳδοὺς ἐν τῷ ὀξυτέρῳ τετραχόρδῳ τοῦ Ἰαστίου τόνου τὴν τοῦ συντόνου χρώματος γένους ἀρμογὴν, ἥτις κατὰ τοὺς κανονικοὺς ἀρμόζεται ἐπὶ τὸ ὀξύ κατὰ τὸν ἐπὶ κα' καὶ ἐπὶ ια' καὶ ἐπὶ ζ' λόγον.
- (20) Εἴτα πάλιν ἐκτίθησιν ἐν τῷ αὐτῷ τετραχόρδῳ ὁμοίως κατὰ τοὺς κιθαρῳδοὺς τὴν τοῦ μαλακοῦ διατόνου γένους ἀρμογὴν, ἥτις πάλιν κατὰ

10 <ἐπὶ> add. Düring 12 τὸ ἕκτον] καὶ τὸ ζ' p τὸ εἰκοστόπρωτον] καὶ τὸ κα' p 13 ρε'] κε' p
 τὸ ἐνδέκατον] καὶ τὸ ια' p 15 α'] κα' p 21 γένους om. p κατὰ] καί p

<of the others> in the | middle and the smaller in the 'following' position; so that in this case, where the ratio 7:6 lies in the leading position, when the one ratio 8:7 is resolved into two ratios, 12:11 and 22:21, the ratio 12:11 leads and the ratio 22:21 follows.⁷⁰⁰ But since the numbers are confused when the ratios are placed like this, and we need fractions and first, second and third numbers,⁷⁰¹ we resolve the ratio 8:7, simply as such, into 22:21 and 12:11 by calculation alone, outside the tetrachord.⁷⁰² | In this way the ratio 22:21 lies first, in the middle of the tetrachord, with 12:11 in the 'following' position, and the numbers remain unconfused. For they are 90 and 105, in which the excess, 15, is a sixth <of 90>; then 110, where the excess, 5, is a twenty-first of 105; and then 120, where the excess, 10, is an eleventh of 110. In this way the tense chromatic *pyknon* is produced, in the | first section of the first chapter of the second book.⁷⁰³ For in it Ptolemy sets out, by the method of the *kitharōidoi*,⁷⁰⁴ the attunement of the tense chromatic genus in the higher tetrachord of the Iastian *tonos*,⁷⁰⁵ an attunement which is formed by the method of the *kanonikoi* in the ratios 22:21, 12:11 and 7:6, taken in ascending order. | Next, by the method of the *kitharōidoi*, as before, he sets out in the same tetrachord the attunement of the soft diatonic genus,⁷⁰⁶

⁷⁰⁰ This is correct, but the point is oddly placed here, since Ptolemy postpones discussion of the ratios into which 8:7 is divided until the end of the chapter.

⁷⁰¹ Ptolemy uses what we would call three-figure numbers, and fractions as well (expressed approximately, as so many sixtieths), to represent the terms of these ratios, when they are set out in sequence in this order. They could of course be multiplied so that they all became integers, but then they would be very large; and Ptolemy's method allows him to use the same numbers, 90 and 120, to represent the outer notes of the tetrachord from which each of his examples begins.

⁷⁰² 'Outside the tetrachord': i.e. independently of the musical considerations that determine the order in which the ratios of the tetrachord are arranged. The arrangement that follows achieves arithmetical simplicity by ignoring the rule that the greater ratio should be in the higher position.

⁷⁰³ Taken at face value, this seems to mean that Ptolemy's representation of the tense chromatic *pyknon* uses the anomalous ordering of ratios that Porphry has just constructed; and that is false. Porphry's reasons for presenting his arithmetically convenient but unmusical arrangement of ratios are obscure.

⁷⁰⁴ From here to 155.30 Porphry's comments on the lemmata are strikingly formulaic, expressed in almost exactly the same way each time.

⁷⁰⁵ The allusion to the Iastian *tonos* ('key') is puzzling. Ptolemy does not use this name for any *tonos*. It is an old name for the one later called Hypophrygian; but there is nothing Hypophrygian about Ptolemy's representation of the tense chromatic tetrachord here; the *tonos* with which he associates it in the context of the attunement called *tropoi* is the Hypodorian (*Harm.* 80.15–16), and he nowhere links it with any other *tonos*. For an attempt to explain Porphry's usage see Hagel (2009): 63–4, and for comment on this and related problems in this chapter see Introduction Section 5(c).

⁷⁰⁶ This statement and the remarks that follow do not correspond to Ptolemy's construction here, which (as is clear from the lemma) does not involve the soft diatonic at all; it does not enter his discussion until *Harm.* 44.13–45.10. What Ptolemy does in the present context is to place two instances of the tense chromatic at different pitch-levels, in such a way that the second-highest note of the first is on the same pitch as the lowest note of the second, and to infer from the resulting relations between their other pitches that the highest interval (in the first, but it would apply also to the second) is greater than the two lowest intervals combined. With certain reservations (see the following notes) Porphry's remarks are acceptable in themselves, but I have no explanation for his substantial divergence from Ptolemy's procedure.

- τοὺς κανονικοὺς ἀρμόζεται ἐπὶ τὸ ὀξύ κατὰ τὸν ἐπὶ κ' καὶ ἐπὶ θ' καὶ ἐπὶ ζ' λόγον, καὶ δείκνυσιν ἐντεῦθεν, ὅτι ἡ νήτη τοῦ συντόνου χρωματικοῦ γένους ὀξυτέρα ἐστὶ τῆς νήτης τοῦ μαλακοῦ διατόνου γένους, καθάπερ
- (25) καὶ τοῖς κανονικοῖς τοῦτο δοκεῖ. καὶ γὰρ ὁ ἐπὶ ζ' λόγος, ὅς ἐστιν ἡγούμενος τοῦ συντόνου χρώματος γένους, μείζων ἐστὶ τοῦ ἐπὶ ζ' λόγου, ὅς ἐστι πάλιν ἡγούμενος τοῦ μαλακοῦ διατόνου γένους. ὅσῳ γὰρ ἐν τῇ κιθάρᾳ λόγος λόγου ἐπὶ τὸ ὀξύ μείζων καθέστηκε, τοσοῦτῳ γ' ἄρα καὶ ὁ φθόγγος φθόγγου ὀξύτερος. θεωρεῖται δ' ἡ ὑπεροχή, ἥ ὑπερέχει ὁ
- (30) ἐπὶ ζ' λόγος τοῦ ἐπὶ ζ' ἐν λόγῳ ἐπὶ μη', καθάπερ διὰ τῶν ἀριθμητικῶν ὁρῶν ἀκριβῶς δείκνυται. τρόπους δ' ἐνταῦθα καλεῖ ὁ Πτολεμαῖος τὰ τοῦ ἡρμοσμένου γένη, ἅπερ ὑπὸ τῶν κιθαρωδῶν μαλακὰ χρώματα κα-
- (154) λεῖται, τρόποι δὲ τοιαῦτα <τά> γένη προσαγορεύονται, διότι ἔνεστιν ἐξ αὐτῶν ποτὲ μὲν ἐπὶ τὸ ἐναρμόνιον, ποτὲ δ' ἐπὶ τὸ διάτονον ἦθος τρέπεσθαι· καὶ γὰρ μεταξὺ ἀμφοῖν τῶν εἰρημένων γενῶν ταῦτα τὴν σύστασιν κέκτηται.

27–8 ἐν τῇ κιθάρᾳ Düring ἢ κιθάρᾳ codd.

1 <τά> add. Düring

which in turn is attuned by the method of the *kanonikoi* in the ratios 21:20, 10:9 and 8:7, taken in ascending order, and he demonstrates from this that the *nētē* of the tense chromatic genus is higher than the *nētē* of the soft diatonic genus, just as | the *kanonikoi* too believe.⁷⁰⁷ For the ratio 7:6, which is the leading ratio in the tense chromatic, is greater than the ratio 8:7, which in its turn is the leading ratio in the soft diatonic genus. For on the kithara, by however much a ratio taken upwards is greater than another, the note will be higher than the other note to the same extent.⁷⁰⁸ The excess by which | the ratio 7:6 exceeds the ratio 8:7 is understood as being in the ratio 49:48, as is accurately shown by the numerical terms.⁷⁰⁹ The reason why Ptolemy gives the name *tropoi* to the genera of attunement which are called 'soft chromatics' by the *kitharōidoi*, and why such genera are called *tropoi*, is that it is possible to turn (*trepesthai*) from them sometimes to the character of the enharmonic and sometimes to that of the diatonic; for the constitution they have is in between those of the genera mentioned.⁷¹⁰

[154D]

⁷⁰⁷ Porphyry repeatedly states in this chapter that a passage quoted from Ptolemy 'demonstrates' a conclusion which in fact is not mentioned there, and which in some cases is irrelevant to Ptolemy's current argument. In each case what Porphyry says that Ptolemy has demonstrated is that a given note in one genus is higher than its counterpart in another, and he adds, each time, 'as the *kanonikoi* too believe'. Since he rarely adds any additional comment on the lemmata, he apparently thought either (implausibly) that Ptolemy's main purpose was to establish the propositions in question, or (almost equally implausibly) that these conclusions, unstated in Ptolemy's text, were the only aspects of it that needed to be clarified. But it is also clear from his repeated couplings of the methods of *kitharōidoi* and the *kanonikoi* that he is also laying emphasis (correctly) on Ptolemy's thesis that the results of the two methods coincide and confirm one another. (In addition to the present passage, see 154.8–11, 25–8, 155.12–15, 24–6.) The sense in which a note in one genus is higher than its counterpart in another is initially puzzling, but Porphyry's point, as he explains immediately, is simply that the interval below it is larger in the first genus than the second. Hence if the note at the bottom of this interval is placed on the same pitch in each case, the note at the top of the interval in the first genus will be higher than it is in the second.

⁷⁰⁸ That is, if an interval in one genus has a greater ratio than its counterpart in another, and if both are constructed upwards from the same pitch, the upper note of the former will be higher than that of the other in the same ratio as that by which the greater ratio is greater than the smaller. The phrase 'on the kithara' is suspect; it involves an emendation of an obviously corrupt text, and the allusion to the instrument seems irrelevant.

⁷⁰⁹ This phrase becomes a repeated refrain in the rest of the chapter. Presumably Porphyry means that the result can be easily calculated from the terms of the ratios.

⁷¹⁰ If this is intended to represent what Ptolemy says, it appears to be confused. In his usage, *tropoi* is not the name of a genus or a group of genera, but of a form of attunement in which two genera, the soft diatonic and the tense chromatic, are combined; just conceivably Porphyry's allusions to genera in the plural might be understood as referring to this combination of genera. The name 'soft chromatics' (also plural) is particularly puzzling, since (a) there is only one soft chromatic, and (b) it plays no part in the attunement in question. Possibly it is a muddled reminiscence of a passage in *Harm.* 1.16 (39.10–11); or perhaps Porphyry is giving the name which his own contemporaries assigned to the attunement which Ptolemy calls *tropoi*. The explanation offered for the name *tropoi* has no basis in Ptolemy, and is almost certainly mistaken. The name *tropoi* for such attunements is unlikely to be as old as the fourth century BC (unless, as is even less likely, it has some connection with the 'first and second of the archaic *tropoi*' mentioned at Aristox. *El. harm.* 23.9–11). But then the possibility of modulation into the enharmonic is irrelevant, since in practice enharmonic music as Aristoxenus and all later theorists conceived it was already almost extinct in Aristoxenus' time. For an enthralling recent discussion see Hagel (2009): 413–29.

Πάλιν μένοντος τοῦ ΑΒΓΔ τετραχόρδου εἰλήφθω ἰσότονος τῷ Β ὁ
F, καὶ ἰστώτος αὐτοῦ πεποιήσθω τὸ ἀπὸ παραμέσης ἐπὶ χρωματικόν [10]

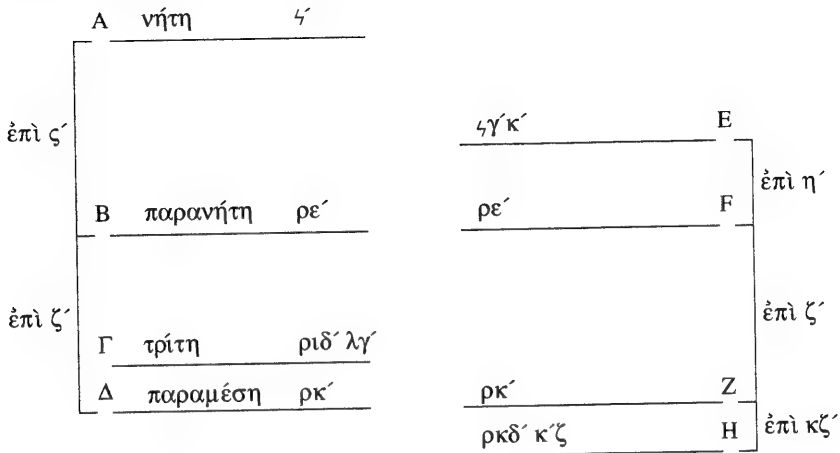


Figure 6G

τῶν στερεῶν διὰ τεσσάρων, ὡς τὸ EFZH, τοῦ E κατὰ τὴν παραμέσιν
τασσομένου. λέγω ὅτι περιέχεται ὑπ' αὐτοῦ τὸ τοῦ τονιαίου διατόνου
γένος, καὶ ὁ μὲν τῶν EF λόγος ἐπὶ η' ἐστίν, ὁ δὲ τῶν FZ ἐπὶ ζ', ὁ δὲ
τῶν ZH ἐπὶ κζ'. οἱ τε γὰρ EF ποιήσουσιν ἀκριβῶς τόνον, τουτέστιν
ἐπὶ η' λόγον, καὶ ὁ Z ἰσότονος εὐρεθήσεται τῷ Δ, ὥστε καὶ τὸν FZ [15]
λόγον τὸν αὐτὸν εἶναι τῷ τῶν ΒΔ, τουτέστιν ἐπὶ ζ', καταλειφθήσεται
τε ὁ τῶν ZH λόγος ἐπὶ κζ', ὅς μετὰ τοῦ ἐπὶ η' καὶ τοῦ ἐπὶ ζ'
συμπληροῖ τὸν ἐπὶ γ'.

- (5) Ἐν δὲ τῷ δευτέρῳ τμήματι τοῦ τοιοῦτου κεφαλαίου πάλιν ὁ Πτολε-
μαῖος ἐκτίθησιν ἐν τῷ αὐτῷ τετραχόρδῳ ὁμοίως κατὰ τοὺς κιθαρωδοὺς
τὴν τοῦ μαλακοῦ ἐντόνου γένους ἀρμογὴν, ἥτις κατὰ τοὺς κανονικοὺς
ἀρμόζεται ἐπὶ τὸ ὀξὺ κατ' ἐπὶ κζ' καὶ ἐπὶ ζ' καὶ ἐπὶ η' λόγον, καὶ δείκνυ-
σιν ἐντεῦθεν, ὅτι ἡ νήτη τοῦ μαλακοῦ διατόνου γένους ὀξυτέρα ἐστὶ τῆς
- (10) νήτης τοῦ μαλακοῦ ἐντόνου γένους, καθάπερ καὶ τοῖς κανονικοῖς τοῦ-
το δοκεῖ. καὶ γὰρ ὁ ἐπὶ ζ' λόγος, ὅς ἐστιν, ὡς εἴρηται, ἡγούμενος τοῦ
μαλακοῦ διατόνου γένους, μείζων ἐστὶ τοῦ ἐπὶ η' λόγου, ὅς ἐστι πάλιν
ἡγούμενος τοῦ μαλακοῦ ἐντόνου γένους. θεωρεῖται δ' ἡ ὑπεροχή, ἥ
ὑπερέχει ὁ ἐπὶ ζ' λόγος τοῦ ἐπὶ η' ἐν λόγῳ ἐπὶ ζγ', καθάπερ διὰ τῶν

Again, letting the tetrachord ABCD stand unchanged, let the note F be taken, of equal pitch to B, and when it is established let there be constructed the tetrachord from *paramesē* to *chrōmatikos* belonging to the *sterea*. Let this be EFZH, with E assigned to *paramesē*.

	A	<i>nētē</i>	90				
7:6					$93\frac{1}{3}$	E	
	B	<i>paranētē</i>	105		105	F	9:8
8:7	C	<i>tritē</i>	$114\frac{6}{11}$				8:7
	D	<i>paramesē</i>	120		120	Z	
					$124\frac{4}{9}$	H	28:27

Figure 6

I say that what is contained by it is the genus of the tonic diatonic, and that the ratio of EF is 9:8, that of FZ is 8:7, and that of ZH is 28:27. For EF will make exactly a tone, that is, the ratio 9:8, and Z will be found to be of equal pitch to D, so that the ratio of FZ is the same as that of BD, that is, the ratio 8:7; and the ratio of ZH is left as 28:27, which together with 9:8 and 8:7 makes up the ratio 4:3. Ptol. *Harm.* 43.9–18

| In the second section of this chapter Ptolemy sets out, again in the same tetrachord and in the same way by the method of the *kitharōidoi*, the attunement of the soft entonic genus,⁷¹¹ which is attuned upwards by the method of the *kanonikoi* in the ratios 28:27, 8:7 and 9:8; and from this he demonstrates that the *nētē* of the soft diatonic genus is higher than the | *nētē* of the soft entonic genus, just as the *kanonikoi* believe.⁷¹² For the ratio 8:7, which is the leading ratio of the soft diatonic genus, as we have said, is greater than the ratio 9:8, which in its turn is the leading ratio of the soft entonic genus. The difference by which the ratio 8:7 exceeds the ratio 9:8 is understood as being in the ratio 64:63, as is | accurately shown by

⁷¹¹ This is the one that Ptolemy calls 'tonic diatonic'; see n. 623 above.

⁷¹² Cf. 153.23–5 with n. 707.

- (15) ἀριθμητικῶν ὄρων ἀκριβῶς δείκνυται. στερεὰ δὲ τετράχορδα καλεῖται τὰ ἔχοντα τὸν διαζευκτικὸν τόνον, ταυτὸν δ' εἶπεῖν τὰ διατονικά.

Ἐξῆς πεποιήσθω τῶν καλουμένων ἰαστιαολίων τὸ ἀπὸ τρίτης ἐπὶ διάτονον διὰ τεσσάρων, ὡς τὸ ΑΒΓΔ, τοῦ Α κατὰ τὴν τρίτην τασσομένου. [20] λέγω ὅτι περιέχεται ὑπ' αὐτοῦ τὸ τοῦ διτονιαίου διατόνου γένος, καθ' ὃ τῶν μὲν ἡγουμένων λόγων ἐκάτερος ἐπὶ ἡ' ἦν, ὃ δὲ λοιπὸς ὁ τοῦ λείμ- [44] ματος. καὶ ἔστιν αὐτόθεν δῆλον. οὕτω γὰρ ἀρμόζονται οἱ κιθαρῳδοί, ὥστε τόνον ἀποτελεῖσθαι καὶ ὑπὸ τῶν ΑΒ καὶ ὑπὸ τῶν ΒΓ, τουτέστι τὸν ἐπὶ ἡ' λόγον, καὶ καταλείπεσθαι τοῖς ΓΔ τὸν τῶν σμγ' πρὸς τὰ σνς', ὃς συμπληροῖ τοῖς δυσὶν ἐπὶ ἡ' τὸν ἐπὶ γ', ἐλάττων μὲν γινόμενος τοῦ ἐπὶ ιη', μείζων δὲ τοῦ ἐπὶ ιθ'. [5]

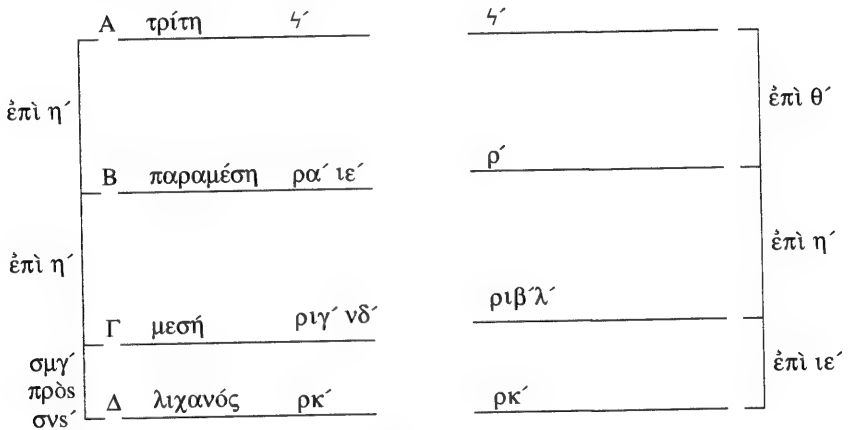


Figure 7G

Ἐάν μέντοι τοῦ ἀκριβοῦς ἤθους ἐχόμενοι καὶ μὴ τοῦ προχείρου τῆς μεταβολῆς ποιῶμεν τὸ ἐκκείμενον τετράχορδον, οἱ μὲν ΒΓ πάλιν ἀποτελέσουσι τὸν τόνον καὶ τὸν ἐπὶ ἡ' λόγον, οἱ δὲ ΑΒ βραχεῖ τόνον ἔλαττον, ὥστε τὸν μὲν τούτου λόγον πίπτειν κατὰ τὸν μείζονα τῶν ἐλαττόνων τοῦ ἐπὶ ἡ', τουτέστι τὸν ἐπὶ θ', τὸν δὲ τῶν ΓΔ κατὰ τὸν ἐπὶ ιε', [10] ὃς συμπληροῖ ἅμα τῷ τε ἐπὶ θ' καὶ τῷ ἐπὶ ἡ' τὸν ἐπὶ γ', καὶ συνίστασθαι τὸ τοῦ συντόνου διατόνου γένος.

- (18) Ἐν τῷ τρίτῳ τμήματι τοῦ τοιοῦτου κεφαλαίου πάλιν ὁ Πτολεμαῖος ἐκτίθησι κατὰ τοὺς κιθαρῳδοὺς ἐν τῷ βαρυτέρῳ τετραχόρδῳ τοῦ Αἰολίου

the numerical terms. The tetrachords that contain the tone of disjunction, which in other words are the 'diatonic' ones, are called *sterea*.⁷¹³

Next let there be constructed the tetrachord from *tritē* to *diatonos* belonging to what is called the *lastiaiolia*. Let this be ABCD, with A assigned to *tritē*. I say that what is contained by it is the genus of the ditonic diatonic, according to which each of the leading ratios is 9:8, and the remaining one is that of the *leimma*. This is immediately obvious. For the *kitharōidoi* make their attunement in such a way that a tone – that is, the ratio 9:8 – is produced both by AB and by BC, and there is left for CD the ratio of 256:243, which together with the two 9:8 ratios fills out the ratio 4:3. It is smaller than the ratio 19:18, greater than 20:19.

If, however, we hold fast to the precise character <of this attunement> and not to what is easy, and construct the tetrachord that was set out as belonging to the *metabolē*, BC will once again produce a tone and the ratio 9:8, but AB will make something a little less than a tone, so that its ratio amounts to the greatest of those that are smaller than 9:8, which is 10:9, and the ratio of CD amounts to 16:15, which along with 10:9 and 9:8 fills out the ratio 4:3; and in this way the genus of the tense diatonic is put together.

	A	<i>tritē</i>	90	90	
9:8					10:9
	B	<i>paramesē</i>	$101\frac{1}{4}$	100	
9:8					9:8
	C	<i>mesē</i>	$113\frac{29}{32}$	$112\frac{1}{2}$	
256:243	D	<i>lichanos</i>	120	120	16:15

Figure 7

Ptol. *Harm.* 43.19–44.12

Again, in the third section of this chapter, Ptolemy sets out, by the method of the *kitharōidoi*, in the lower tetrachord of the Aeolian |

⁷¹³ Ptolemy tells us in I.16 that *sterea* is the name that musicians give to an attunement constructed throughout in the tonic diatonic (or 'soft entonic'). It 'contains the tone of disjunction' in the sense that one of its ratios is the same as that of the tone by which tetrachords are disjoined from one another, 9:8; and this makes it 'dia-tonic', proceeding 'through the tone'.

- (20) τόνου τήν τε τοῦ διτονιαίου <διατόνου> γένους ἀρμογὴν, ἥτις κατὰ τοὺς κανονικοὺς,
ὡς <εἴρηται>, ἀρμόζεται ἐπὶ τὸ ὄξύ κατὰ τὸ καλούμενον ὑπὸ μὲν τῶν μουσικῶν ἡμιτόνιον, ὑπὸ δὲ τῶν κανονικῶν λεῖμμα, καὶ ἐπὶ ἡ' λόγον καὶ ἐπὶ ἡ' λόγον, καὶ ἔτι τήν τοῦ συντόνου διατόνου γένους, ἥτις πάλιν κατὰ τοὺς κανονικοὺς ἀρμόζεται ἐπὶ τὸ ὄξύ κατὰ τὸν ἐπὶ ιε' καὶ ἐπὶ ἡ' καὶ
- (25) ἐπὶ θ' λόγον. καὶ δείκνυσιν ἐντεῦθεν, ὅτι οὐ μόνον ἡ νῆτη τοῦ διτονιαίου διατόνου γένους ὀξυτέρα ἐστὶ τῆς νήτης τοῦ συντόνου διατόνου γένους, καθὼς καὶ τοῖς κανονικοῖς τοῦτο δοκεῖ, ἀλλὰ καὶ ἡ παρυπάτη τοῦ συντόνου διατόνου γένους τῆς παρυπάτης τοῦ διτονιαίου διατόνου γένους. καὶ γὰρ ὥσπερ ὁ ἐπὶ ἡ' λόγος, ὅς ἐστιν ἡγούμενος τοῦ διτονιαίου διατόνου γένους, μείζων ἐστὶ τοῦ ἐπὶ θ' λόγου, ὅς ἐστι πάλιν ἡγούμενος τοῦ συντόνου διατόνου γένους, οὕτω γε καὶ ὁ ἐπὶ ιε', ὅς ἐστιν ἔσχατος
- (30) τοῦ συντόνου διατόνου γένους, μείζων ἐστὶ τοῦ ἐπὶ ιη' λόγου τοῦ ἀντὶ τοῦ λείμματος παρειλημμένου, ὅς ἐστι πάλιν ὁ ἔσχατος τοῦ διτονιαίου διατόνου γένους. θεωρεῖται ἡ μὲν ὑπεροχή, ἥ ὑπερέχει ὁ ἐπὶ ἡ' λόγος τοῦ ἐπὶ θ' λόγου, ἐν λόγῳ ἐπὶ π', ἡ δ' ὑπεροχή, ἥ ὑπερέχει ὁ ἐπὶ ιε' λόγος τοῦ ἐπὶ ιη' λόγου, ὅς ἀντὶ τοῦ λείμματος, ὥσπερ εἴρηται, παρείληπται, ἐν ἐπὶ θε', καθάπερ διὰ τῶν ἀριθμητικῶν ὅρων ἀκριβῶς δείκνυται.
- (155)
- (5)

Πάλιν μένοντος τοῦ ΑΒΓΔ διὰ τεσσάρων—λέγω δὲ κατὰ τὴν διτονιαίαν ἀρμογὴν—πεποιήσθω ἰσότονος τῷ Δ ὁ Η, καὶ ἡρμόσθω ἀπ' αὐτοῦ ἐπὶ τὸ ὄξύ τὸ ἀπὸ μέσης ἐπὶ ὑπάτην ἐν ταῖς παρυπάταις διὰ τεσσάρων, ὡς τὸ ΕFΖΗ, τοῦ Ζ ποιοῦντος τὴν παρυπάτην. φημὶ ὅτι περιέχεται

20 <διατόνου> addidi 21 <εἴρηται> add. Wallis 28 διατόνου^{prim.} om. p

2 ὁ om. p 3 θεωρεῖται] θεωρεῖ δὲ ἡ p 5 ante ἀντὶ add. ἐστὶν p 6 θε'] ε' typographico errore Düring

tonos,⁷¹⁴ both the attunement of the ditonic diatonic genus, which by the method of the *kanonikoi* is attuned upwards in the interval which the *mousikoi* call the half-tone but the *kanonikoi* call the *leimma*, and in the ratios 9:8 and 9:8, and also that of the tense diatonic genus, which in turn is attuned upwards by the method of the *kanonikoi* in the ratios 16:15, 9:8 and | 10:9. And from this he shows that not only is the *nētē* of the ditonic diatonic genus higher than the *nētē* of the tense diatonic genus, just as the *kanonikoi* too believe, but the *parhypatē* of the tense diatonic genus is also higher than the *parhypatē* of the ditonic diatonic genus.⁷¹⁵ For just as the ratio 9:8, which is the leading ratio of the ditonic diatonic | genus, is greater than the ratio 10:9, which in turn is the leading ratio of the tense diatonic genus, so too the ratio 16:15, which is the last ratio of the tense diatonic genus, is greater than the ratio 19:18 which is adopted in place of the *leimma*, and which is in turn the last ratio of the ditonic diatonic genus.⁷¹⁶ The difference by which the ratio 9:8 exceeds the ratio 10:9 is understood as being in the ratio 81:80; and the difference by which the ratio 16:15 exceeds | the ratio 19:18, which is adopted instead of the *leimma*, as has been said, is understood as being in the ratio 96:95, as is shown accurately by the numerical terms.

[155D]

Again, letting the tetrachord ABCD stand unchanged – I mean, according to the attunement of the ditonic diatonic – let there be constructed the note H, equal in pitch to D, and let there be attuned upwards from it the tetrachord from *mesē*, to *hypatē* in the *parhypatai*. Let this be EFZH, with Z making *parhypatē*.

⁷¹⁴ 'Aeolian' is an alternative name for the *tonos* called 'lower Lydian'; but this appears only in the Aristoxenian system of thirteen keys, and is not among the seven that Ptolemy recognises (see *Harm.* II.7–11). We might suppose that Porphyry means the so-called Hypoaeolian (later 'lower Hypolydian'), lying a perfect fourth below the Aeolian, but this too is not recognised as a *tonos* by Ptolemy. The *tonos* to which he assigns the tetrachords in question is the Hypophrygian, and although this is close in pitch to the Aristoxenian 'lower Hypolydian' (roughly a half-tone below it), its intervals are differently arranged in the two-octave system. Cf. 153.17 above with n. 705, and see n. 715 below.

⁷¹⁵ Cf. 153.23–5 with n. 707. The names which Porphyry gives to the notes differ from Ptolemy's in this passage, partly because *Iastiaiolia* (elsewhere called *Iastia*) is in the Hypophrygian *tonos* (*Harm.* II.16), in which, when the notes are named by reference to their position in the two-octave system ('by *thesis*'), the names differ from those they are given when specified by their harmonic function ('by *dynamis*'); on this distinction see *Harm.* II.5). Ptolemy names the notes by *thesis* throughout this chapter; Porphyry names them here by *dynamis*, so that he gives the name *parhypatē* to the note which Ptolemy calls *mesē*. Even so, an oddity remains, since if the tetrachord in question has *parhypatē* as its second-lowest note, its highest note is not *nētē* but either *hypatē* (*mesōn*) or *mesē*.

⁷¹⁶ Porphyry's conclusions at 130.1–7 show that the *leimma* is smaller than 19:18 but greater than 20:19. He 'adopts' the approximation 19:18 in this passage, rather than the true ratio of 256:243, partly, no doubt, for the sake of arithmetical convenience, though we may note that Ptolemy does the same at 45.4 ff (see the next lemma).

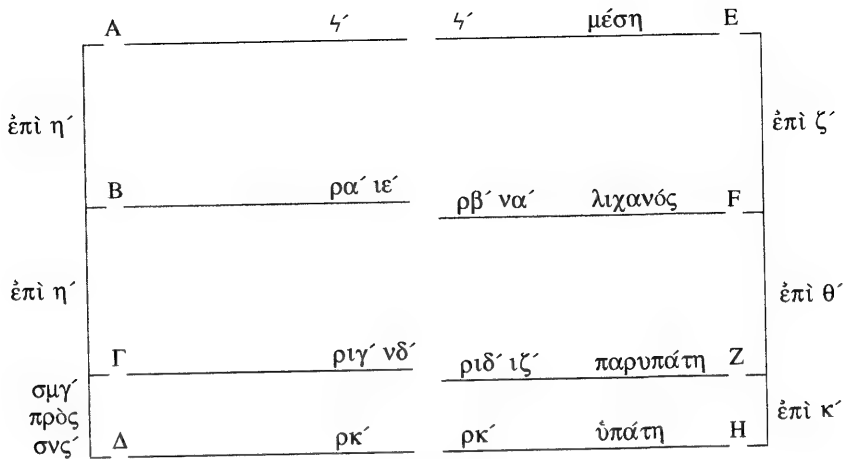


Figure 8G

ὕπ' αὐτοῦ τὸ τοῦ μαλακοῦ διατόνου γένος, καθ' ὃ τὸν μὲν ἡγούμενον λόγον εὐρήκειμεν ἐπὶ ζ', τὸν δὲ μέσον ἐπὶ θ', τὸν δὲ λοιπὸν ἐπὶ κ'. ὅτι [45] μὲν οὖν ὁ τῶν EF λόγος ἐπὶ ζ' ἐστίν, δέδεικται ἐπὶ τῶν στερεῶν οὐδὲ εἰς γὰρ αὐτῶν ἐνταῦθα κεκίνηται. δεικτέον δ' ὅτι καὶ ὁ μὲν τῶν FZ γίνεται ἐπὶ θ', ὁ δὲ τῶν ZH ἐπὶ κ'. εὐρεθήσεται μὲν τοίνυν ὁ Γ τοῦ Z βραχεῖ ὀξύτερος, ὥστε ἐλάττωνα εἶναι τὸν τῶν ZH λόγον τοῦ τῶν ΓΔ, τουτέστι τοῦ ἐπὶ ιη'. ποιήσουσι δὲ οἱ FZ ἑλάττον τόνου, ὥστε καὶ [5] τὸν τῶν FZ λόγον ἐλάττωνα εἶναι ἐπὶ η', καὶ ἐστὶν ὁ τῶν FH λόγος ἐπὶ ζ', ἐπεὶ καὶ ὁ τῶν EF ἐπὶ ζ'. καὶ οὐ πληροῦσιν ἄλλοι δύο λόγοι τὸν ἐπὶ ζ', ὧν ὁ μὲν ἐλάττων ἐστὶν ἐπὶ η', ὁ δὲ ἐλάττων ἐπὶ ιη', εἰ μὴ ὅ τε ἐπὶ θ' καὶ ὁ ἐπὶ κ'. ἔστι δὲ τοῦ ἐπὶ ιη' ἐλάττων ὁ τῶν ZH λόγος. οὗτος μὲν ἄρα ἔσται ἐπὶ κ', ὁ δὲ τῶν FZ ἐπὶ θ'. [10]

- Ἐν τῷ πέμπτῳ τμήματι τοῦ τοιοῦτου κεφαλαίου πάλιν ἐκτίθησιν ὁ
- (10) Πτολεμαῖος ἐν τῷ αὐτῷ τετραχόρδῳ κατὰ τοὺς κιθαρωδοὺς τὴν τοῦ μαλακοῦ διατόνου γένους ἀρμογὴν, ἥτις κατὰ τοὺς κανονικοὺς ἀρμόζεται, ὡς εἴρηται, ἐπὶ τὸ ὀξύ κατ' ἐπὶ κ' καὶ ἐπὶ θ' καὶ ἐπὶ ζ' λόγον, καὶ δείκνυσιν ἐντεῦθεν, ὅτι ὀξυτέρα ἐστὶν ἢ παρυπάτη τοῦ διτονιαίου διατόνου γένους τῆς παρυπάτης τοῦ μαλακοῦ διατόνου γένους, καθὼς καὶ τοῖς
- (15) κανονικοῖς τοῦτο δοκεῖ. καὶ ὁ ἐπὶ ιη' λόγος, ὅς ἐστιν ὁ ἔσχατος τοῦ διτονιαίου διατόνου γένους, μείζων ἐστὶ τοῦ ἐπὶ κ' λόγος, ὅς ἐστι πάλιν ὁ ἔσχατος τοῦ μαλακοῦ διατόνου γένους. θεωρεῖται δ' ἡ ὑπεροχή, ἢ ὑπερέχει ὁ ἐπὶ ιη' λόγος τοῦ ἐπὶ κ' λόγου ἐν λόγῳ ἐπὶ ρηθ', καθάπερ διὰ τῶν ἀριθμητικῶν ὄρων ἀκριβῶς δείκνυνται.

	A	90	90	<i>mesē</i>	E	
9:8						8:7
	B	$101\frac{1}{4}$	$102\frac{6}{7}$	<i>lichanos</i>	F	
9:8						10:9
	C	$113\frac{29}{32}$	$114\frac{2}{7}$	<i>parhypatē</i>	Z	
256:243	D	120	120	<i>hypatē</i>	H	21:20

Figure 8

I say that what this contains is the genus of the soft diatonic, according to which we would find the leading ratio to be 8:7, the middle one to be 10:9, and the remaining one 21:20. That the ratio of EF is 8:7 has been shown from the case of the *sterea*, for neither one of them has been altered <from that ratio> here. But it must be shown that the ratio of FZ comes to 10:9, and that of ZH to 21:20. Now C will be found to be a little higher than Z, so that the ratio of ZH is smaller than that of CD, that is, than 19:18. But FZ will make something smaller than a tone, so that the ratio of FZ is also smaller than 9:8; and the ratio of FH is 7:6, since that of EF is 8:7. And there are no two ratios that fill out the ratio 7:6 except 10:9 and 21:20. But it is the ratio of ZH that is smaller than 19:18. Hence it will be 21:20, while the ratio of FZ will be 10:9. Ptol. *Harm.* 44.13–45.10

Again, in the fifth section of this chapter, Ptolemy | sets out in the same tetrachord, by the method of the *kitharōidoi*, the attunement of the soft diatonic, which by the method of the *kanonikoi* is attuned upwards, as has been said, in the ratios 21:20, 10:9 and 8:7, and from this he shows that the *parhypatē* of the ditonic diatonic genus is higher than the *parhypatē* of the soft diatonic genus, just as the | *kanonikoi* too believe.⁷¹⁷ And the ratio 19:18, which is the last ratio of the ditonic diatonic genus, is greater than the ratio 21:20, which in turn is the last ratio of the soft diatonic genus. The difference by which the ratio 19:18 exceeds the ratio 21:20 is understood as being in the ratio 190:189, as is shown accurately by the numerical terms.

⁷¹⁷ Cf. 153.23–5 with n. 707.

Λοιπόν δε μένοντος τοῦ ΕΦΖΗ τετραχόρδου πεποιήσθω ἰσότητος τῶν Ζ ὁ Γ, καὶ ἐστῶτος αὐτοῦ ἡμόσθω τὸ ΑΒΓΔ διὰ τεσσάρων τοῦ ἐξαρχῆς χρωματικοῦ, τοῦ Α πάλιν κατὰ τὸν ὀξύτατον τασσομένου, ὥστε τὸν τῶν ΒΔ λόγον εἶναι ἐπὶ ζ'. δεικτέον ὅτι καὶ ὁ μὲν τῶν ΒΓ λόγος

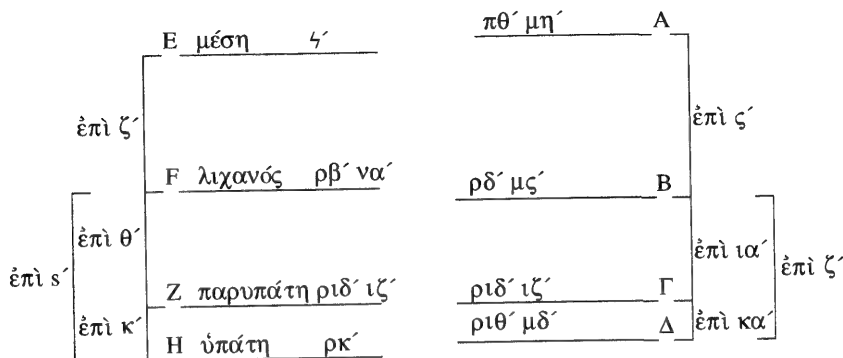


Figure 9G

ἔσται ἐπὶ ια', ὁ δὲ τῶν ΓΔ ἐπὶ κα'. εὐρεθήσεται τοίνυν ὁ μὲν Δ τοῦ [15]
 Η βραχεῖ ὀξύτερος, ὥστε ἐλάττωνα εἶναι τὸν τῶν ΓΔ λόγον τοῦ τῶν
 ΖΗ, τοῦτέστι τοῦ ἐπὶ κ', ὁ δὲ Β τοῦ F βαρύτερος αἰσθητῶς, ὥστε
 ἐλάττωνα εἶναι καὶ τὸν τῶν ΒΓ λόγον τοῦ τῶν FΖ, τοῦτέστι τοῦ ἐπὶ θ'.

- (21) Πάλιν ὁ Πτολεμαῖος ἐκτίθησιν ἐν τῷ αὐτῷ τετραχόρδῳ κατὰ τοὺς
κιθαρῳδοὺς τὴν τοῦ συντόνου χρώματος γένους ἁρμογὴν, ἥτις κατὰ τοὺς
κανονικοὺς ἁρμόζεται ἐπὶ τὸ ὀξύ κατ' ἐπὶ κα' καὶ ἐπὶ ια' καὶ ἐπὶ ς',
(25) ὁξυτέρα ἐστὶ τῆς παρυπάτης τοῦ χρωματικοῦ συντόνου γένους, καθάπερ
καὶ τοῖς κανονικοῖς τοῦτο δοκεῖ. καὶ γὰρ ὁ ἐπὶ κ' λόγος, ὃς ἐστὶν ἔσχα-
τος, ὡς εἴρηται, τοῦ μαλακοῦ διατόνου γένους, μείζων ἐστὶ τοῦ ἐπὶ κα'
λόγου, ὃς ἐστὶν ἔσχατος τοῦ συντόνου χρώματος γένους. θεωρεῖται δ'
ἡ ὑπεροχή, ἥ ὑπερέχει ὁ ἐπὶ κ' λόγος τοῦ ἐπὶ κα' λόγου, ἐν λόγῳ ἐπὶ υμ',
(30) καθάπερ διὰ τῶν ἀριθμητικῶν ὄρων ἀκριβῶς δείκνυται.
Ἀναγκαῖον δ' εἶδέναι, ὅτι οὐ δύναται ἡ ἀκοὴ τὰς τῶν ἐλαττόνων τῶν
(156) παρίσων λόγων ὑπεροχὰς τε καὶ ἐλλείψεις ἀκριβῶς διαισθάνεσθαι· καὶ

| Finally, letting the tetrachord EFZH stand unchanged, let the note C be constructed, of equal pitch to Z, and when it is established let there be attuned the tetrachord ABCD belonging to the original [i.e. the tense] chromatic, A being once again assigned to the highest note, so that the ratio of BD is 8:7. It is to be shown that the ratio of BC is 12:11, while that of CD is 22:21.

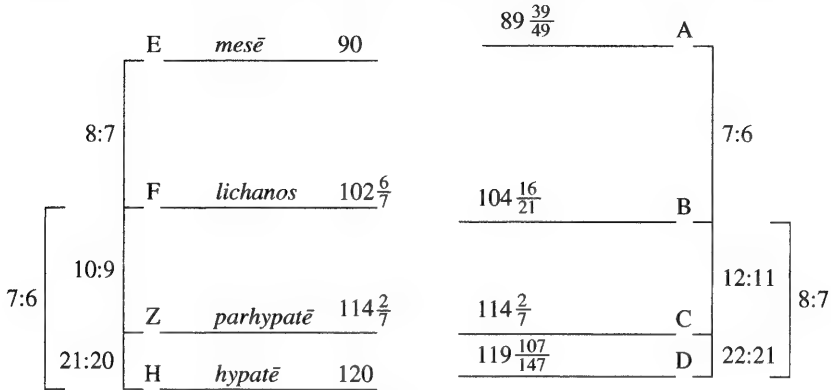


Figure 9

Now D will be found to be a little higher than H, so that the ratio of CD is smaller than that of ZH, that is, than the ratio 21:20; while B is perceptibly lower than F, so that the ratio BC is smaller than that of FZ, that is, than the ratio 10:9.⁷¹⁸ Ptol. *Harm.* 45.11–18

Again, Ptolemy sets out in the same tetrachord, by the method of the *kitharōidoi*, the attunement of the tense chromatic genus, which by the method of the *kanonikoi* is attuned upwards in the ratios 22:21, 12:11 and 7:6, and from this he shows that the *parhypatē* of the soft diatonic genus | is higher than the *parhypatē* of the tense chromatic genus, just as the *kanonikoi* too believe.⁷¹⁹ For the ratio 21:20, which is the last ratio, as has been said, of the soft diatonic genus, is greater than the ratio 22:21, which is the last ratio of the tense chromatic genus. The difference by which the ratio 21:20 exceeds the ratio 22:21 is understood as being in the ratio 441:440, | as is shown accurately by the numerical terms.

One must understand that the hearing cannot accurately distinguish the extent to which the smaller of the nearly equal ratios exceed or fall

[156D]

⁷¹⁸ The argument of this passage continues to the end of the chapter, but Porphyry omits 45.19–22 here and inserts it as the next lemma.

⁷¹⁹ Cf. 153.23–5 above with n. 707.

διὰ τοῦτο οἱ κιθαρωδοὶ πολλαχοῦ τοῦ καλῶς ἡρμοσμένου διαμαρτάνουσιν. εἰδέναι δεῖ καὶ τοῦτο, ὅτι τῶν τοῦ ἡρμοσμένου γενῶν ἃ μὲν ἐξ ἰδίων λόγων συνίστανται, ἃ δ' ἐκ κοινῶν, ἃ δ' ἐκ κοινῶν τε καὶ ἰδίων,

- (5) καὶ διὰ τοῦτο ἐν τῇ κιθάρᾳ τινὰ τῶν γενῶν ἐξ ἄλλων προϋποκειμένων γενῶν δύνανται ἀρμόζεσθαι μηδενὸς λόγου κινουμένου ἐν τῇ ἀρμογῇ. διὸ καὶ ὁ Πτολεμαῖος ταῦτα ἐν τῷ προκειμένῳ κεφαλαίῳ δείκνυσι διὰ τῆς τῶν γενῶν μεταλήψεως. εἰδέναι δεῖ καὶ τοῦτο, ὅτι οἱ κιθαρωδοὶ τετράσι τόνοις ὡς ἐπὶ τὸ πλεῖστον ἐχρῶντο, τῷ Ὑπολυδίῳ, τῷ Ἰαστίῳ,
- (10) τῷ Αἰολίῳ καὶ τῷ Ὑπεριαστίῳ.

οὐδένες δὲ λόγοι πάλιν συμπληροῦσι τὸν ἐπὶ ζ', ὧν ὁ μὲν ἐλάττων ἐστὶν ἐπὶ θ', ὁ δὲ ἐλάττων ἐπὶ κ', εἰ μὴ ὁ τε ἐπὶ ια' καὶ ὁ ἐπὶ κα', καὶ ἔστι [20] τοῦ ἐπὶ κ' ἐλάττων ὁ τῶν ΓΔ λόγος, ὥστε οὗτος μὲν ἔσται ἐπὶ κα', λοιπὸς δὲ ὁ τῶν ΒΓ ἐπὶ ια'. ἅπερ προύκειτο δεῖξαι.

- (12) Πρῶην μὲν ἐν τοῖς φθάσαςι κατὰ τὸ μαλακὸν διάτονον γένος τὸ συμπληρούμενον ἐξ ἐπὶ ζ' καὶ ἐπὶ ζ' τῶν δύο διαστημάτων τὸν ἐπὶ ζ' δύο λόγοι συνεπλήρουν, ὧν ὁ μὲν εἷς ἐξ ἀνάγκης ἦν μείζων, ὁ δ' ἕτερος ἐλάττων. οὐκ ἦν δὲ ὁ μὲν μείζων ἐπὶ η', ὁ δ' ἐλάττων ἐπὶ ιη', ὥστ' εἶναι τοὺς ποιοῦντας αὐτοὺς τοὺς δύο τὸν ις', τὸν ιη', τὸν ιθ'. οὐ γὰρ ὁ ιθ' πρὸς τὸν ις' συνάγει τὸν ἐπὶ ζ', ἀλλὰ τῶν δύο λόγων τῶν ποιοῦντων τὸν ἐπὶ ζ' ὁ μὲν μείζων ἦν ἐπὶ θ', ὥσπερ ὁ κ' πρὸς τὸν ιη', ὁ δ' ἐλάττων ἐπὶ κ', ὡς ὁ κα' πρὸς τὸν κ', ὃς δὴ κα' συνάγει πρὸς τὸν ιη' τὸν ἐπὶ ζ'. ἔνι
- (20) δ' ὁ ἐπὶ κ' ἔχων μόνιον ἔλαττον τοῦ ἐπὶ ιη'· διὸ καὶ τούτου ἐλάττων ἐστὶν ὁ ἐπὶ κ'. πρῶην μὲν οὖν ταῦτα· νῦν δ' ἐν τούτοις δεικνύει, πῶς

10 περιαστίῳ p

in lemmate 45.19 ἐλάττων] μείζων codd.

short of one another;⁷²⁰ and for this reason the *kitharōidoi* often fail to attain that which is well attuned. One must also understand this, that some of the genera of attunement are put together from ratios specific to themselves, some from ones that are shared, and some from both shared ratios and ones specific to themselves, | and for this reason some of the genera can be attuned on the kithara from other genera that have been established previously, without shifting any ratio in the attunement.⁷²¹ Thus this is what Ptolemy demonstrates in the present chapter, through the interchange of the genera. One must also understand this, that the *kitharōidoi* for the most part made use of four *tonoi*, the Hypolydian, the Iastian, | the Aeolian and the Hyperastian.⁷²²

Once again, no ratios fill out the ratio 8:7, one of which is smaller than 10:9, the other smaller than 21:20, except 12:11 and 22:21; and it is the ratio of CD that is smaller than 21:20, so that it will be 22:21, and that of BC is left as being 12:11. And that is what was to be shown. Ptol. *Harm.* 45.19–22

We saw above in the preceding discussion that in the soft diatonic genus, it was the ratio 7:6, out of the two intervals in the ratios 7:6 and 8:7, that was filled up by two ratios together, of which one was necessarily greater and the other smaller. | But it is not the case that the greater was 9:8 and the smaller 19:18,⁷²³ making the numbers that form them 16, 18, 19; for 19 in relation to 16 does not produce the ratio 7:6. Rather, the greater of the two ratios making the ratio 7:6 was 10:9, for instance the number 20 in relation to 18, and the smaller was 21:20, for instance the number 21 in relation to 20; and 21 in relation to 18 produces the ratio 7:6. The | ratio 21:20 contains a smaller part than the ratio 19:18,⁷²⁴ and is therefore smaller than that one. These points were established above; but now Ptolemy shows in these

⁷²⁰ Here I paraphrase; literally 'the excesses and fallings-short of the smaller of the nearly equal ratios'.

⁷²¹ None of the divisions considered in this chapter has ratios all of which are shared with some other division or divisions (though some do so if we take into account the other divisions listed in *Harm.* I.15). All the diatonics share at least one ratio with another; only the tense chromatic is made up entirely of ratios peculiar to itself. Porphyry's last statement probably means that in cases where a ratio is shared between two attunements, one can transfer the shared ratio unchanged to the second, and then go on to construct the remainder. (His remark might be taken to mean that one can construct a different attunement without changing any of the ratios at all, but that is obviously false.)

⁷²² These are not the names of the *tonoi* to which Ptolemy assigns the tunings (*Harm.* II.16); cf. nn. 714–15 above. A persuasive explanation of the apparent anomaly is offered in Hagel (2009): 61–5; for the gist of it see Introduction Section 5(c). The remarks in this paragraph seem oddly placed; they would more naturally have appeared at the end of the chapter.

⁷²³ Porphyry continues to use 19:18 as his point of reference; it is the approximation to the *leimma* (256:243) which was adopted at 154.31–155.3.

⁷²⁴ In each ratio the greater term contains the smaller plus a fraction of the smaller, and the fraction involved in the ratio 21:20 is smaller than it is in the ratio 19:18.

- (25) τὸν ἐπὶ ζ' λόγον συμπληροῦσιν ἄλλοι δύο λόγοι, ὁ μὲν μείζων, ὁ δ' ἐλάττων, ὥστε γενέσθαι τὸ σύντονον χρωματικὸν ἐκ τριῶν διαστημάτων· οὐ μὴν μείζων μὲν ἐστὶν ἐν τούτοις ὁ ἐπὶ θ' ὡς πρὸς τὸν ιη' ὁ κ', ἐλάττων δ' ὁ ἐπὶ κ' ὡς πρὸς τὸν κ' ὁ κα'. οὐ γὰρ οὗτος πρὸς τὸν ιη' συνάγει τὸν ἐπὶ ζ', ἀλλὰ συμπληροῦσιν αὐτὸν δὴ τὸν ἐπὶ ζ' δύο λόγοι, μείζων μὲν ὁ ἐπὶ ια' ὡς πρὸς τὸν κβ' ὁ κδ', ἐλάττων δ' ὁ ἐπὶ κα' ὡς ὁ κβ' πρὸς τὸν κα', πρὸς δὲ ὁ κδ' συνάγει τὸν ἐπὶ ζ'.

β'

[46.2] Αἱ μὲν οὖν περὶ τὰ γένη τῶν τετραχόρδων διαφοραὶ κατὰ τούτους ἡμῖν συνεστάθησαν τοὺς τρόπους διὰ τῆς τῶν ἀνισοτόνων φθόγγων ἀνακρίσεως καὶ παραβολῆς.

- (157) Παρέβαλε καὶ ἀνέκρινεν <έν> τῷ πρώτῳ τοὺς ἀνισοτόνους φθόγγους καὶ τὰς διαφορὰς τῶν τετραχόρδων περὶ τὰ τρία γένη τῆς ἀρμονίας, τὸ διάτονον, τὸ ἐναρμόνιον καὶ τὸ μέσον τούτων τὸ χρωματικὸν συνέστησε· διὰ τοῦτο γὰρ καὶ χρωματικὸν ἐκλήθη οἶμαι, ὅτι τοῦ μὲν διατονικοῦ κατὰ
- (5) τόνους διηρημένου—ἐπὶ η' γὰρ καὶ ἐπὶ η' καὶ λείμμα τοῦτο συνίστησιν, ὃ ἐστὶ τόνος, τόνος καὶ ἡμιτόνιον—τοῦ δ' ἐναρμονίου κατὰ διέσεις—δίτονον γὰρ καὶ διέσεις καὶ διέσεις τοῦτο συνίστησιν, ὡς γίνεσθαι καὶ αὐτὸ δύο ἡμίσεις τόνων—τὸ χρωματικὸν κατὰ ἡμιτόνια συνίσταται—τριημιτόνιον γὰρ καὶ ἡμιτόνιον καὶ ἡμιτόνιον τοῦτο συνίστησιν, τὸ δ'
- (10) ἡμιτόνιον μέσον τόνου καὶ διέσεως ἐστίν.

Διδάξας δὲ περὶ τῆς διαφορᾶς αὐτῶν καὶ μᾶλλον περὶ τῶν συνηθεστέρων—οὐ γὰρ καὶ περὶ τῶν ὀκτώ εἶπεν, ὧν τὰ μὲν πέντε διατονικὰ λέγονται, τὰ δὲ δύο χρωματικά, τὸ δ' ἐν ἐναρμόνιον· διὸ οὐδὲ κυρίως ἂν γένος κληθεῖν τὸ τοιοῦτον, ὡς χροᾶς ἦγουν εἶδη μὴ ἔχον—νῦν εἰσβάλ-

28 τέλος τοῦ α' κεφαλαίου add. p 29 ἀρχὴ τοῦ β' κεφαλαίου add. p κεφ. β' εἰς τὸ αἱ μὲν οὖν περὶ τὰ γένη G

1 ἀνέκρινεν <έν> τῷ Düring ἀνέκρινε τῷ codd. 13 ἐν om. p

statements how two other ratios, one greater and the other smaller, together fill up the ratio 8:7, so that the tense chromatic is constructed from three intervals. But it is not the case that the greater among them is 10:9, for instance the number 20 in relation to 18, and that the smaller | is 21:20, for instance the number 21 in relation to 20; for 21 in relation to 18 does not produce the ratio 8:7. Two ratios do indeed together fill out this ratio, 8:7, however, the greater being 12:11, for instance the number 24 in relation to 22, and the smaller 22:21, for instance the number 22 in relation to 21; and 24 produces the ratio 8:7 in relation to 21.

Chapter 2

| The differences between tetrachords corresponding to the genera have thus been established for us by these methods, through the assessment and comparison of notes of unequal pitch. Ptol. *Harm.* 46.2–4

In his first book⁷²⁵ Ptolemy has compared and assessed the notes of unequal pitch, and has established the differences between the tetrachords in the three genera of attunement, the diatonic, the enharmonic and the one in between them, the chromatic. I think it was called ‘chromatic’ for the following reason, that whereas the diatonic | is divided by tones – for it is composed of the ratios 9:8, 9:8 and the *leimma*, which is tone, tone and half-tone – and the enharmonic by dieses – for it is composed of ditone, diesis and diesis, so that it too amounts to two and a half tones – the chromatic is put together by half-tones – for it is composed of trihemitone, half-tone and half-tone, and the half-tone | is in between a tone and a diesis.⁷²⁶ [157D]

After teaching about the differences between them, and especially between those that are more familiar – for he did not speak about the eight, of which five are called diatonic, two chromatic and one enharmonic (which for this reason⁷²⁷ should not properly be called a genus, since it

⁷²⁵ I.e. in *Harm.* I.15.

⁷²⁶ In talking of ditones, tones, half-tones and dieses (here quarter-tones) Porphyry uses the language of the Aristoxenian handbooks which readers knew from their school texts. The forms he assigns to each of the genera are also those that non-specialists were most likely to have learned; they were sometimes treated as the only representatives of the genera even in technical writings, and were regularly presented in this way in works aimed at a wider public. In the context of Ptolemy’s discussions, and of mathematical harmonics in any of its guises, the language, the implication that such intervals as tones can be halved, and the assumption that an exact ditone can figure as a theoretically correct melodic interval are of course thoroughly misleading.

⁷²⁷ That is, because it takes only one form, whereas – so Porphyry assumes – a genus must be a class divided into distinct species. On the term *chroa* see n. 676 above.

- (15) λει δι' ὀργάνου ἐνός, ὃ δὴ ἑλικῶνά φασιν ἀπ' ὄρους Ἑλικῶνος, ὅπου αἱ Μοῦσαι μυθεύονται χορεύειν, δεῖξαι ἐν ταύτῳ καὶ τὰς ἐξ συμφωνίας συνισταμένας ἀλλὰ καὶ αὐτὸν δὴ τὸν ἀρχικὸν ἐπὶ ἡ', καθ' ὃ διαφέρει ὁ διὰ πέντε τοῦ διὰ τεσσάρων, ὅτι καὶ τοῦ ἐπὶ γ' ὁ ἡμιόλιος τῷ ἐπὶ ἡ' διαφέρει, ὡς ἐπὶ τοῦ ζ', οὐ ὁ ἡ' ἐπὶ γ', ὁ δὲ θ' ἡμιόλιος, ὁ δὲ θ' πρὸς αὐτὸν δὴ τὸν ἡ' ἐπὶ ἡ' λόγον ἔχει, πρὸς τὸν ζ' τὸν ἡμιόλιον συμπληροῖ.
- (20) Ἀλλὰ πρότερον περὶ τῶν εἰδῶν τῶν γενῶν λεκτέον. εἰσὶ γὰρ τῶν μὲν διατονικῶν αἱ πέντε χροαὶ αὐταὶ· διάτονον ὁμαλὸν ἐξ ἐπὶ θ', ἐπὶ ι', ἐπὶ ια' ἐπὶ τὸ βαρὺ, ἐπὶ δὲ τὸ ὀξύ ἐναντίως· διάτονον σύντονον ἐξ ἐπὶ θ', ἐπὶ ἡ' καὶ ἐπὶ ιε' ἐπὶ τὸ βαρὺ· διάτονον μαλακὸν ἐξ ἐπὶ ζ', ἐπὶ θ' καὶ
- (25) ἐπὶ κ' ἐπὶ τὸ βαρὺ· μαλακὸν ἔντονον ἐξ ἐπὶ ἡ', ἐπὶ ζ' καὶ ἐπὶ κζ' ἐπὶ τὸ βαρὺ· διτονιαῖον διάτονον ἐξ ἐπὶ ἡ', ἐπὶ ἡ' καὶ λείμματος. τοῦ δὲ χρωματικῆς αἱ χροαὶ δύο· χρωματικὸν σύντονον ἐξ ἐπὶ ζ', ἐπὶ ια' καὶ ἐπὶ κα' ἐπὶ τὸ βαρὺ, καὶ χρωματικὸν μαλακὸν ἐξ ἐπὶ ε', ἐπὶ ιδ' καὶ ἐπὶ κζ'. καὶ ἐπὶ τούτοις τὸ ἐναρμόνιον ἐξ ἐπὶ δ', ἐπὶ κγ' καὶ ἐπὶ με'. ἀλλὰ
- (30) νῦν διὰ τοῦ ἑλικῶνος τὰς ἐξ συμφωνίας συνιστᾶ καὶ αὐτὸν δὴ τὸν τόνον, τὴν ἐπὶ γ' δηλονότι τὴν καὶ διὰ τεσσάρων, τὴν ἡμιολίαν, ἣτις λέγεται διὰ πέντε, τὴν διὰ πασῶν τὴν καὶ διπλασίαν, τὴν διὰ πασῶν καὶ διὰ τεσσάρων ἔχουσαν λόγον τὸν τῶν ὀκτώ πρὸς τὰ τρία, τὴν διὰ πασῶν καὶ διὰ πέντε τὴν τριπλασίαν καὶ τὴν δις διὰ πασῶν τὴν καὶ τετραπλασίαν
- (35) καὶ αὐτὸν τὸν ἐπὶ ἡ'.

- (158) γίνοιτο δ' ἂν ἡ κατὰ τὸν ὀκτάχορδον κα-
 νόνα τοῦ διὰ πασῶν χρῆσις καὶ καθ' ἕτερον τρόπον παρὰ τὸ καλούμενον [5]
 ὄργανον ἑλικῶνα, πεπονημένον τοῖς ἀπὸ τῶν μαθημάτων εἰς τὴν ἔνδει-
 ξιν τῶν ἐν ταῖς συμφωνίαις λόγων οὕτως· πῶς. ἐκτίθενται τετράγωνον
 ὡς τὸ ΑΒΓΔ καὶ διελόντες δίχα τὰς ΑΒ καὶ ΒΔ κατὰ τὰ Ε καὶ Ζ
 ἐπιζευγνύουσι μὲν τὰς ΑΖ καὶ ΒΗΓ, διάγουσι δὲ παρὰ τὴν ΑΓ
 διὰ μὲν τοῦ Ε τὴν ΕΘΚ, διὰ δὲ τοῦ Η τὴν ΗΜ. αὐτόθεν μὲν οὖν ἡ [10]
 ΑΓ ἐκατέρας τῶν ΒΖ καὶ ΖΔ ὑπόκειται διπλασία καὶ ἔτι τούτων ἐκα-
 τέρα τῆς ΕΘ, ἐπεὶ καὶ ἡ ΑΒ τῆς ΑΕ, ὥστε καὶ τὴν ΑΓ τῆς μὲν ΕΘ
 τετραπλασίαν εἶναι, λοιπῆς δὲ τῆς ΘΚ ἐπίτριτον. δεικνύται δὲ ὅτι καὶ
 ἡ ΜΗ τῆς ΗΛ διπλασία ἐστίν, ἐπειδήπερ, ὡς μὲν ἡ ΔΓ πρὸς τὴν ΓΜ,
 οὕτως ἡ ΔΒ πρὸς τὴν ΗΜ, ὡς δὲ ἡ ΒΑ πρὸς τὴν ΑΛ, οὕτως ἡ ΒΖ [15]
 πρὸς τὴν ΛΗ· καὶ διὰ τοῦτο ὡς ἡ ΒΔ πρὸς τὴν ΗΜ, οὕτως ἡ ΒΖ πρὸς
 τὴν ΛΗ, καὶ ἐναλλάξ, ὡς ἡ ΒΔ πρὸς τὴν ΒΖ, οὕτως ἡ ΜΗ πρὸς τὴν ΛΗ.

19 ὁ δὲ θ' ἡμιόλιος om. p 20 ἔχει] ἔχω p 24 μαλακόν — 25 βαρὺ om. p 31 τὴν καί]
 καὶ τὴν p 32 τὴν καὶ Düring καὶ τὴν p καὶ om. G

contains no *chroai* or species) – he now sets off to show, | by means of the instrument which they call the *helikōn* after the mountain Helikon where the myths say the Muses dance, not only the six concords constructed on it, but also the initial epogdoic⁷²⁸ by which the fifth differs from the fourth, for the hemiolic differs from the epitritie by an epogdoic; for instance if we take 6, of which 8 is the epitritie and 9 the hemiolic, 9 | makes an epogdoic ratio in relation to 8, and in relation to 6 it completes the hemiolic.

But before that we must speak of the species of the genera.⁷²⁹ The five *chroai* of the diatonics are these: the even diatonic, composed from 10:9, 11:10 and 12:11 downwards, the reverse upwards; the tense diatonic, composed from 10:9, 9:8 and 16:15 downwards; the soft diatonic, composed from 8:7, 10:9 and | 21:20 downwards; the soft entonic,⁷³⁰ composed from 9:8, 8:7 and 28:27 downwards; and the ditonic diatonic, composed from 9:8, 9:8 and the *leimma*. There are two *chroai* of the chromatic: the tense chromatic composed from 7:6, 12:11 and 22:21 downwards; and the soft chromatic, composed from 6:5, 15:14 and 28:27. In addition to these there is the enharmonic, composed from 5:4, 24:23 and 46:45. But | now he sets up the six concords and the tone by means of the *helikōn*, the epitritie which is of course also the fourth, the hemiolic which is called the fifth, the octave which is also duple, the octave and a fourth which has the ratio of 8:3, the octave and a fifth which is the triple, the double octave which is also the quadruple, | and also the epogdoic.

It is possible to use the eight-stringed *kanōn* of the octave in a different way too, in conjunction with the instrument called the *helikōn*, which has been made by students of mathematics to display the ratios in the concords, in the following sort of way. [158D]

They construct a square, ABCD, and after dividing AB and BD in half at E and Z, they join up AZ and BHC, and draw parallel to AC the line EFK through E, and the line LHM through H.

It follows from this that AC is double each of BZ and ZD, and each of these is double EF, since AB is also double AE, so that it is also the case that AC is four times EF, and is the epitritie of the remainder FK. It is also shown that MH is double HL, since as DC is to CM, so is DB to HM, and as BA is to AL, so is BZ to LH. And for this reason, as BD is to HM, so is BZ to LH; and conversely, as BD is to BZ, so is MH to LH. Then AC is the

⁷²⁸ The 'initial' (*archikos*) ratio is the ratio expressed in its lowest whole-number terms, which Porphyry elsewhere calls the 'foundation' (*pythmēn*) of the ratio.

⁷²⁹ It is not clear why Porphyry inserts this account of the species or *chroai* here. It adds details to his remarks about the eight systems in the previous paragraph, but it adds nothing to the contents of I.15, and it is irrelevant to the discussion of the construction of concords on the *helikōn*.

⁷³⁰ See n. 623 above.

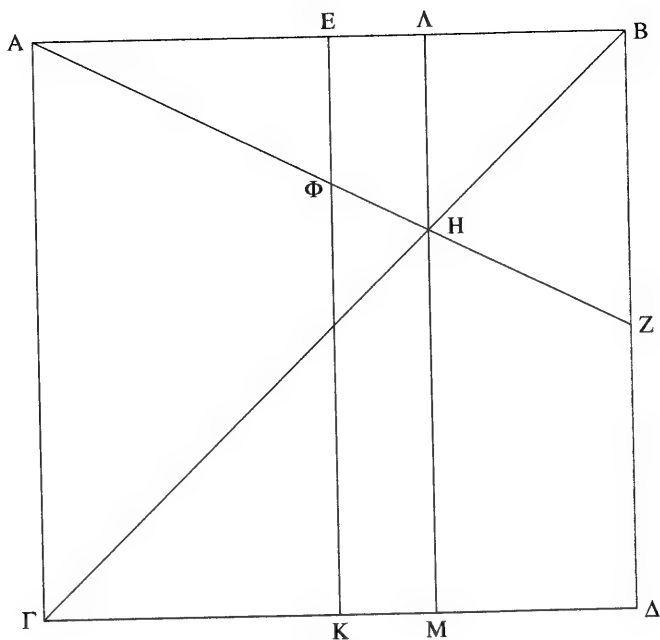


Figure 10G

[47] γίνεται ἄρα ἡ ΑΓ καὶ τῆς μὲν ΗΜ ἡμιολία, τῆς δὲ ΗΛ τριπλασία, ὥστε διαταθεισῶν χορδῶν τεσσάρων ἰσοτόνων κατὰ τὰς αὐτάς θέσεις τὰς τῶν ΑΓ καὶ ΕΚ καὶ ΛΜ καὶ ΒΔ εὐθειῶν, καὶ ὑπαχθέντος αὐταῖς κανονίου κατὰ τὴν τῆς ΑΘΗΖ θέσιν, ἐφαρμοσθέντων τε ἀριθμῶν τῇ μὲν ΑΓ τοῦ τῶν ιβ', τῇ δὲ ΘΚ τοῦ τῶν θ', τῇ δὲ ΗΜ τοῦ τῶν η', ἑκα- [5] τέρα δὲ τῶν ΒΖ καὶ ΖΔ τοῦ τῶν ζ', καὶ πάλιν τῇ μὲν ΑΗ τοῦ τῶν δ', τῇ δὲ ΕΘ τοῦ τῶν γ', ἀποτελεῖσθαι πάσας τὰς συμφωνίας καὶ τὸν τόνον, τῆς μὲν διὰ τεσσάρων καὶ κατὰ τὸν ἐπὶ γ' λόγον συνισταμένης ὑπὸ τε τῶν ΑΓ καὶ ΘΚ καὶ ὑπὸ τῶν ΗΜ καὶ ΖΔ καὶ ὑπὸ τῶν ΑΗ καὶ ΘΕ, τῆς δὲ διὰ πέντε καὶ ἐν τῷ ἡμολίῳ λόγῳ ὑπὸ τε τῶν ΑΓ καὶ ΗΜ καὶ [10] ὑπὸ τῶν ΘΚ καὶ ΖΔ καὶ ὑπὸ τῶν ΒΖ καὶ ΑΗ, τῆς δὲ διὰ πασῶν καὶ κατὰ τὸν διπλάσιον λόγον ὑπὸ τε τῶν ΑΓ καὶ ΖΔ καὶ ὑπὸ τῶν ΗΜ καὶ ΑΗ καὶ ὑπὸ τῶν ΒΖ καὶ ΘΕ, τῆς δὲ διὰ πασῶν καὶ διὰ τεσσάρων ἐν τῷ τῶν η' πρὸς τὰ γ' λόγῳ ὑπὸ τῶν ΗΜ καὶ ΘΕ, τῆς δὲ διὰ πασῶν καὶ διὰ πέντε καὶ κατὰ τὸν τριπλάσιον λόγον ὑπὸ τῶν ΑΓ καὶ ΑΗ, [15] τῆς δὲ δις διὰ πασῶν καὶ κατὰ τὸν τετραπλάσιον λόγον ὑπὸ τῶν ΑΓ καὶ ΕΘ, καὶ ἔτι τοῦ τόνου κατὰ τὸν ἐπὶ η' λόγον ὑπὸ τῶν ΘΚ καὶ ΗΜ.

Παρά δὴ τοῦτο τὸ ὄργανον ἐὰν ἐκθώμεθα παραλληλόγραμμον ἀπλῶς ὡς τὸ ΑΒΓΔ...

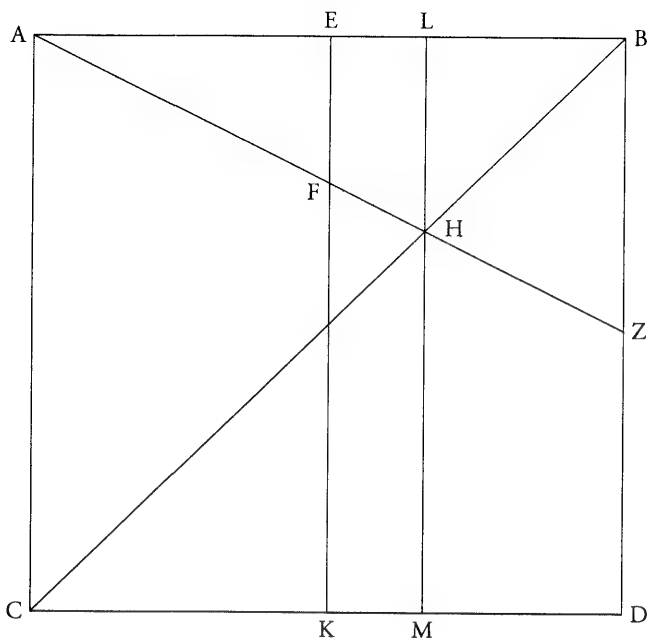


Figure 10

hemiotic of HM and triple HL; so that when four strings of equal pitch are arranged in the same positions as those of the straight lines AC, EK, LM and BD, and when a rod (*kanonion*) is placed under them in the position of AFHZ, and when the following numbers are assigned to them, 12 to AC, 9 to FK, 8 to HM, 6 to each of BZ and ZD, 4 to LH and 3 to EF, then there are produced all the concords and the tone, that of the fourth, in epitritie ratio, being constituted by AC and FK and by HM and ZD and by LH and FE, that of the fifth, in hemiotic ratio, by AC and HM and by FK and ZD and by BZ and LH, that of the octave, in double ratio, by AC and ZD and by HM and LH and by BZ and FE, that of the octave and a fourth, in the ratio of 8 to 3, by HM and FE, that of the octave and a fifth, in triple ratio, by AC and LH, that of the double octave, in quadruple ratio, by AC and EF, and finally the tone, in epogdoic ratio, by FK and HM.

Next to this instrument, suppose that we draw a rectangle ABCD . . . ⁷³¹ Ptol. *Harm.* 46.4–47.19

He says 'the eight-stringed *kanōn*', even though the concords cannot all be set up on only eight strings; for neither the octave and a fourth nor the

⁷³¹ The lemma stops part way through a sentence which sets out in a new direction; it would more naturally appear at the beginning of the next lemma, in which the sentence is continued.

- (2) Κατὰ τὸν ὀκτάχορδόν φησι κανόνα, καίτοι ἐν ὀκτῶ καὶ μόνοις χορδαῖς οὐ δύνανται πᾶσαι αἱ συμφωνίαι συνίστασθαι· οὔτε γὰρ τὸ διὰ πασῶν καὶ διὰ τεσσάρων, οὔτε τὸ διὰ πασῶν καὶ διὰ πέντε, οὔτε τὸ δις διὰ
- (5) πασῶν, ἀλλὰ μόνα τὰ τρία ταῦτα, τὸ διὰ τεσσάρων, τὸ διὰ πέντε καὶ τὸ ἐξ αὐτῶν ἀναπληρούμενον διὰ πασῶν. ἔστιν οὖν εἰπεῖν, ὅτι ὁ ἐλικῶν οὗτος, ὅσον κατὰ τοὺς ἄκρους, ἰβ' γὰρ καὶ ζ', τὸν διπλάσιον λόγον ἀποτελεῖ ἐν συμφωνίᾳ τῇ διὰ πασῶν. ἐπεὶ δ' ὁ διπλάσιος λόγος ἐξ ἐπὶ γ' καὶ ἐπὶ η' καὶ αὖθις ἐπὶ γ' συνίσταται, ἰβ' γὰρ καὶ θ' καὶ η' καὶ ζ', τῶν
- (10) ἐντὸς δύο παραλλήλων τοὺς λόγους τούτους συνιστάντων πλὴν διαιρουμένων διὰ τῶν πλαγίων, ὥς κατὰ τὰς τομὰς τοὺς ἀριθμοὺς ἐναπολαμβάνεσθαι, καθ' οὓς καὶ οἱ λοιποὶ λόγοι συνίστανται, εὐρίσκονται ἐντεῦθεν καὶ αἱ λοιπαὶ τρεῖς συμφωνίαι ἐντὸς τῶν τοιούτων διαιρέσεων. καὶ κατὰ τοῦτο μᾶλλον τὸ ὄργανον χρησιμώτατον, ὅτι τὴν διὰ πασῶν συμφωνίαν
- (15) ἐν τοῖς ἄκροις περιέχειν δυνάμενον τμηθείσης δίχα τῆς μιᾶς πλευρᾶς. ὁμῶς ζητηθέντων καὶ τῶν ἐντὸς αὐτῆς λόγων, τοῦ ἐπὶ γ' φημί, τοῦ ἐπὶ η' καὶ αὖθις ἐπὶ γ' καὶ αἱ λοιπαὶ συμφωνίαι διὰ τῶν πρὸς ἀλλήλους αὐτῶν καὶ τῶν λοιπῶν λόγων εὐρέθησαν πλὴν οὐχ ἅπαξ μία ἐκάστη, ἀλλὰ θαυμασίως καὶ φύσεως λόγῳ αἱ μὲν οἰκεῖται πλεονάκεις, αἱ δὲ παρεθεῖσαι
- (20) διὰ τῆς τῶν μέσων ἀναπτύξεως ἅπαξ. ἡ γὰρ διὰ τεσσάρων τρίς, ὑπὸ τε τῶν ΑΓ καὶ ΘΚ, καὶ ὑπὸ τῶν ΗΜ καὶ ΖΔ, καὶ ὑπὸ τῶν ΛΗ καὶ ΕΘ. ἡ δὲ διὰ πέντε καὶ αὕτη τρίς, ὑπὸ τε τῶν ΑΓ καὶ ΗΜ, καὶ ὑπὸ τῶν ΘΚ καὶ ΖΔ, καὶ ὑπὸ τῶν ΒΖ καὶ ΛΗ· καὶ ἡ διὰ πασῶν τρίς καὶ αὕτη, ὑπὸ τῶν ΑΓ καὶ ΖΔ, καὶ ὑπὸ τῶν ΗΜ καὶ ΛΗ, καὶ ὑπὸ τῶν ΒΖ καὶ ΘΕ·
- (25) ἡ δὲ διὰ πασῶν καὶ διὰ τεσσάρων ἅπαξ, ὑπὸ τῶν ΗΜ καὶ ΘΕ· ὁμοίως καὶ ἡ διὰ πασῶν καὶ διὰ πέντε ἅπαξ ὑπὸ τῶν ΑΓ καὶ ΛΗ, καὶ ἡ δις διὰ πασῶν ἅπαξ καὶ αὕτη ὑπὸ τῶν ΑΓ καὶ ΕΘ· ὁ δὲ τόνος καὶ αὐτὸς ἅπαξ ὑπὸ τῶν ΘΚ καὶ ΗΜ.

octave and a fifth nor the double octave <can be set up>, but only the following three, the fourth, the fifth and the one | made up from them, the octave.⁷³² We can say, then, that this *helikōn*, so far as its extreme terms, 12 and 6, are concerned, produces the double ratio in the concord of the octave. And since the double ratio is composed from the ratios 4:3 and 9:8 and 4:3 again, for we have 12, 9, 8, 6, and the | two inner parallels construct these ratios – that is, when divided by the diagonals so as to meet these numbers at the intersections – the remaining three ratios too are found from this within these same divisions. And the instrument is of great value even more for the following reason, that it can contain the concord of the octave | in the extreme terms when just one side is divided in half. Nevertheless, when the ratios inside the octave were also sought, I mean 4:3 and 9:8 and 4:3 again and the remaining concords, through their ratios to one another and through the remaining ratios, they were found, except that each one was not found once only, but the proper concords, marvellously and through the reason inherent in nature, were found several times over, while those set beside them were found once, | through the analysis of the middle <lines or strings>.⁷³³ For the fourth appears three times, <in the ratios> between AC and FK, HM and ZD, and LH and EF; the fifth again three times, between AC and HM, FK and ZD, and BZ and LH; the octave again three times, between AC and ZD, HM and LH, and BZ and FE; | the octave and a fourth once, between HM and FE; similarly, the octave and a fifth once, between AC and LH; and the double octave again once, between AC and EF. The tone also appears once, between FK and HM.

⁷³² Perhaps Porphyry means that Ptolemy's statement is surprising, since one might suppose that the eight-stringed instrument spanning an octave which Ptolemy mentions cannot contain the greater concords. (In fact Ptolemy shows in *Harm.* III.2 how a complete two-octave attunement can be set up on an 'ordinary' eight-stringed instrument like that described in I.11; but that is irrelevant here.) In that case we would expect his subsequent remarks about this lemma to explain why Ptolemy is right after all. But the *helikōn* it describes has only four strings. Porphyry is confusing this part of Ptolemy's discussion, in which all the concords in the double octave are constructed on four strings, with the next (*Harm.* 47.18–48.14), where he constructs a different instrument with eight strings, based on the principles of the mathematicians' *helikōn* but capable of exhibiting all the ratios of a complete octave attunement.

⁷³³ By the 'proper' (*oikeiai*) concords Porphyry evidently means the three fundamental ones, fourth, fifth and octave, though this is an unusual way of describing them; those 'set beside them' are those formed by combining any one of them with the octave. 'Analysis' represents *anaptyxis*, literally an 'opening' or 'unfolding'. The noun and its cognates very rarely appear in contexts of this sort; they are used most often in texts concerned with the interpretation of words, where they typically refer to the 'explication' of the meaning of a word or a statement. Porphyry uses the cognate verb in this sense at 38.5 and 45.31 above, and occasionally elsewhere in his writings; no such word occurs anywhere in Ptolemy.

καὶ νοήσωμεν τὰς μὲν AB καὶ $\Gamma\Delta$ κατὰ τὰ ἀποψάσματα
[48] τῶν χορδῶν, τὰς δὲ $ΑΓ$ καὶ $ΒΔ$ κατὰ τοὺς ἄκρους φθόγγους τοῦ διὰ

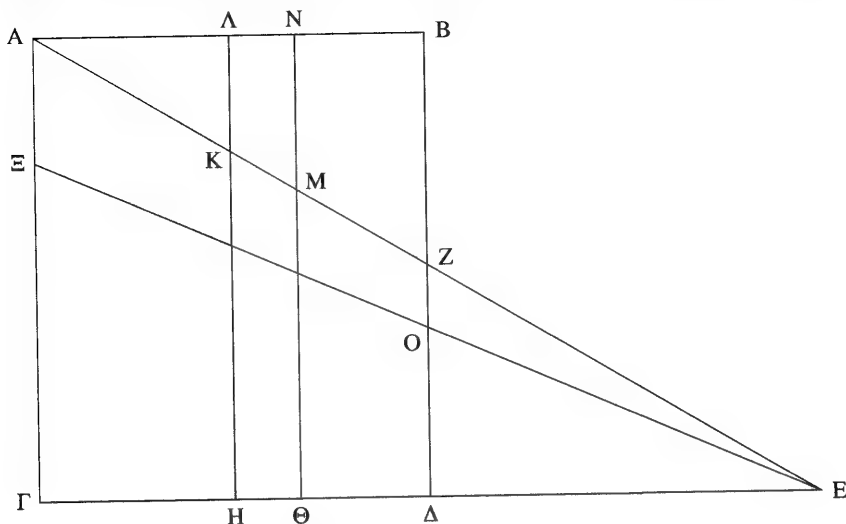


Figure 11G

πασῶν, ἔπειτα προσεκβαλόντες τῇ $\Gamma\Delta$ ἴσην τὴν ΔE κατατέμωμεν
ἀντὶ τῶν κανονίων τὴν $\Gamma\Delta$ πλευρὰν τοῖς οἰκείοις τῶν γενῶν λόγοις,
ἐπὶ τοῦ E τὸ ὄξυ πέρας ὑποτιθέμενοι, καὶ διὰ τῶν γινομένων ἐπ' αὐτῆς
τομῶν τείνωμεν τὰς χορδὰς παραλλήλους τε τῇ $ΑΓ$ καὶ ἰσοτόνους ἀλλή- [5]
λαις, καὶ τούτου γενομένου τὸν κοινὸν ἐσόμενον ὑπαγωγέα τῶν χορδῶν
ὑποβάλλωμεν αὐταῖς κατὰ τὴν ὑποζευγνῦσαν τὰ AE σημεῖα θέσιν ὡς
τὸν AZE , ποιήσομεν πάντα μήκη τῶν χορδῶν ἐν τοῖς αὐτοῖς λόγοις,
ὥστε ἐπιδέχεσθαι τὴν τῶν ἐφηρμοσμένων τοῖς γένεσι λόγων ἀνάκρισιν.
ἐπειδήπερ, ὡς αἱ ἀπὸ τοῦ E λαμβανόμεναι κατὰ τὴν $\Gamma\Delta$ πρὸς ἀλλήλας [10]
ἔχουσιν, οὕτω καὶ αἱ διὰ τῶν περάτων αὐτῶν ἀναγόμεναι παρὰ τὴν
 $ΑΓ$ μέχρι τῆς AZ ἔξουσιν πρὸς ἀλλήλας, οἷον ὡς ἡ $EΓ$ πρὸς τὴν $ΕΔ$,
οὕτως ἡ $ΓΑ$ πρὸς τὴν ΔZ · διόπερ αὗται μὲν ποιήσουσι τὸ διὰ πασῶν,
ὅτι διπλάσιος αὐτῶν ὁ λόγος.

Ἐὰν δὲ ἀπολαβόντες πάλιν ἀπὸ τῆς $\Gamma\Delta$ τὴν μὲν $ΓΗ$ κατὰ τὸ τέ- [15]
ταρτον μέρος τῆς $EΓ$, τὴν δὲ $ΓΘ$ κατὰ τὸ τρίτον τῆς αὐτῆς, ἀναστή-
σωμεν καὶ διὰ τῶν H καὶ Θ χορδὰς, ὡς τὰς $ΗΚΛ$ καὶ ΘMN ταῖς πρώ-
ταις ἰσοτόνους, ὥστε καὶ τὴν τε $ΑΓ$ τῆς μὲν $ΗΚ$ γίνεσθαι ἐπίτритον,
τῆς δὲ ΘM ἡμιολίαν καὶ πάλιν τῆς ΔZ τὴν μὲν ΘM ἐπίτритον, τὴν δὲ
 $ΗΚ$ ἡμιολίαν καὶ ἔτι τὴν $ΗΚ$ τῆς ΘM ἐπὶ ἡ', ποιούσι καὶ αὗται πρὸς [20]

<Next⁷³⁴ to this instrument, suppose that we draw up a rectangle ABCD,> and think of AB and CD as the *apopsalmata* of the strings, and AC and BD as the extreme notes of the octave. Then we add DE, equal to and extending CD, and divide the side CD, by the application of rulers (*kanonia*), in the ratios proper to the genera, making E the limit of high pitch.

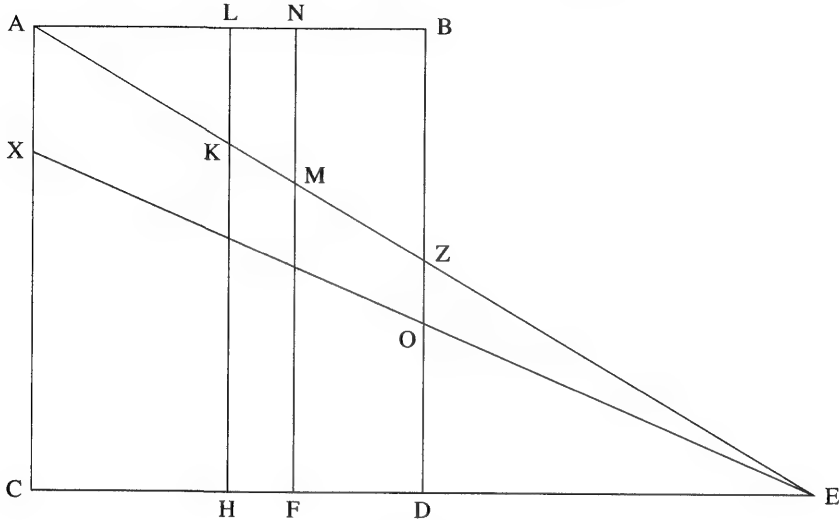


Figure II

Through the resulting points of division on it we stretch strings parallel to AC and equal to one another in pitch, and when this is done we place under them what will be the bridge common to the strings, in the position, AZE, that joins the points A and E. In this way we shall make all the lengths of the strings in the same ratios <as those marked on CD>, so that it makes possible the assessment of the ratios that have been assigned to the genera. For as the lines taken from E along CD stand to one another, so will those drawn parallel to AC, from their limits as far as AZ. For instance, as EC is to ED, so is CA to DZ. Hence these lines will make the octave, since their ratio is the double. Suppose, once again, that we mark off on CD the line CH, as a fourth part of EC, and CF as a third of the same line, and locate strings through H and F, HKL and FMN, equal in pitch to the first ones, so that AC becomes the epitritic of HK and the hemiolic of FM, and again FM becomes the epitritic of DZ and HK becomes the hemiolic of DZ, and again HK is to FM in the ratio 9:8. Then these will make in relation to one

⁷³⁴ For clarity's sake I have added the beginning of the first sentence of this passage, which is quoted at the end of the previous lemma.

ἀλλήλας τὰς ἀκολουθούς τοῖς λόγοις συμφωνίας, τοῦ παραπλησίου παρακολουθήσαντος καὶ ἐπὶ τῶν μεταξύ τοῖν τετραχόρδοιν λαμβανομένων τμημάτων ἐν τοῖς οἰκείοις τῶν ἀνακρινόμενων λόγοις.

- (30) Ἀποψάλματά φησι, καθ' ἃ τοὺς ἤχους αἱ χορδαὶ ἀποδιδοῦσιν, ὅπου εἰσι δηλονότι δεδεμέναι. εἰ γοῦν νοήσομέν φησι τὴν ἄνω κεραίαν τὴν
- (159) ΑΒ καὶ τὴν κάτω τὴν ΓΔ κατὰ τὰ ἀποψάλματα, τὰς δὲ κατὰ τὸ πλάγιον ἰσταμένας τὴν ΑΓ καὶ ΒΔ κατὰ τοὺς ἄκρους φθόγγους τὴν μὲν ΑΓ ὄλην, τὴν δὲ ΒΔ ἄλλως καὶ ἄλλως τεμνομένην κατὰ τὸν μεταβιβαζόμενον ἐν ταύτῃ ὑπαγωγέα, ὡς γίνεσθαι καὶ τὴν διὰ πασῶν πάντως συμφωνίαν
- (5) κατὰ τὸν διπλάσιον λόγον τμηθείσης δίχα δι' ὑπαγωγέως τῆς ΑΖΕ· προσεκβάλωμεν δὲ καὶ ἴσην τῇ ΓΔ τὴν ΔΕ, ὡς φθάνειν τὸν ὑπαγωγέα μέχρι τοῦ Ε, κατατέμωμεν δὲ τοῖς οἰκείοις ἐκάστου γένους λόγοις τὴν ὑποκάτω ΓΔ, ὡς ποιῆσαι τὴν ΓΗ ἡμίσειαν τῆς ὅλης ΓΔ καὶ ταύτην διπλασίαν ἐκείνης, καὶ διὰ τοῦτο τὴν ΕΓ τετραπλασίονα πρὸς αὐτὴν
- (10) τὴν ΓΗ, καὶ αὖθις κατὰ τὸ Θ, ὡς εἶναι τῆς ΓΘ ἡμιολίαν τὴν ΘΔ καὶ διὰ ταῦτα πᾶσαν τὴν ΕΓ τριπλασίαν αὐτῆς δὴ τῆς ΓΘ· καὶ αὖθις ποιήσωμεν ἐντὸς τῆς πλευρᾶς αὐτῆς μόνης τῆς ΓΔ τὴν μὲν ὄλην ΓΔ πρὸς τὴν ΓΗ διπλασίαν, τὴν δὲ ΓΘ πρὸς τὴν ΗΓ ἐπὶ γ', καὶ διὰ τῶν τομῶν χορδὰς παραλλήλους τῇ ΑΓ τείνωμεν, ποιήσομεν ἴσα τὰ μήκη πάντα
- (15) τῶν χορδῶν, ὥστ' ἐπιδέχεσθαι τὰ τετράχορδα ταῦτα τὴν ἐκάστου γένους ἀνάκρισιν. ἔσται γάρ ὁ μὲν διπλάσιος λόγος, ὃν ἔχει ἡ ΓΔ πρὸς τὴν ΓΗ, ἐκ δύο τετραχόρδων καὶ τονικοῦ ἐπὶ η', ὁ δ' ἐπὶ γ' λόγος, ὃν ἔχει ἡ ΓΘ πρὸς τὴν ΓΗ, ἐκ τετραχόρδου [καὶ] μόνου. ὁ δ' ἡμιόλιος, ὃν ἔχει πᾶσα ἡ ΓΔ πρὸς τὴν ΓΘ, ἐκ τετραχόρδου καὶ τόνου· καὶ οὕτως αἰεὶ τὰ τε-
- (20) τράχορδα προηγῆσονται, ὥστε δέχεσθαι ταύτας τὰς διαφορὰς τῶν γενῶν

5 τῆς Høeg (1934) τοῦ codd.
codd. 14 ποιήσωμεν G

10 τῆς ΓΘ Alexanderson τὴν ΓΘ codd. τὴν ΓΔ Alexanderson τῆς ΘΔ
17 τετραχόρδου G 18 [καὶ] delevi 20 ταῦτα G

another the concords that go with these ratios, and the equivalent result will follow for the divisions inside the tetrachords, taken in the ratios appropriate to those that are being assessed.⁷³⁵ Ptol. *Harm.* 47.19–48.23

| The *apopsalmata* he mentions are those between which the strings give out their sounds, that is, obviously, the points where they are fixed.⁷³⁶ Thus, he says, we shall think⁷³⁷ of the upper *keraiia*,⁷³⁸ AB, and the lower one, CD, as the *apopsalmata*, and of the <strings> set at the sides, AC and BD, as the extreme notes, with AC taken as a whole, and BD divided in various ways by the bridge that is shifted along it, so that the concord of an octave | in double ratio always arises when BD is divided in half by the bridge AZE.⁷³⁹ Let us also make the extension DE, equal to CD, so that the bridge ends at E, and let us divide the lower bridge CD in the ratios appropriate to each genus, making CH half of the whole CD and the latter double the former, and hence making EC four times | CH; and let us divide it again at F, making CD the hemiolic of CF, and hence making the whole EC the triple of CF. And again, on CD by itself, inside the line of the side, let us make the whole CD double CH, and CF in epitritic ratio with HC; and let us stretch strings, parallel to AC, through the points of division. We shall make all the lengths | of the strings equal, so that these tetrachords will provide for the assessment of each genus. For the double ratio, in which CD stands to CH, will be constituted from two tetrachords and a tone in the ratio 9:8; the ratio 4:3, in which CF stands to CH, will be constituted from a tetrachord by itself; and the hemiolic ratio, in which the whole CD stands to CF, will be constituted from a tetrachord and a tone. In this way | the tetrachords will always take the lead, so as to receive the differences

[159D]

⁷³⁵ For discussions of this instrument see Barker (2000): 206–12, 215–29 *passim*, (2009b), Creese (2010): 338–45.

⁷³⁶ The word *apopsalma* ('thing plucked') refers most naturally to the part of a string that is plucked to produce a sound; Ptolemy uses it in this sense at e.g. *Harm.* 17.25, 18.7. Here, however, as Porphyry says, it refers to the points at which the strings are fixed, which elsewhere Ptolemy calls the 'limits' or 'beginnings' of the *apopsalmata*. As is made clear below, these are not the pegs on which the strings are wound or tied, but the parallel bridges, AB and CD, which form the extreme limits of the strings' sounding-lengths.

⁷³⁷ Porphyry writes 'Thus, he says, if we think . . .'; and the passage from here to 159.16 is probably best construed as one enormous though syntactically ill-formed sentence. I have slightly recast it and broken it up for the sake of intelligibility.

⁷³⁸ A *keraiia* is literally something made of horn, but it can refer to things made of other substances if they are in some way similar to horns, especially if they are long and straight (e.g. beams or the yard-arms of ships). Here it refers to the fixed bridge which forms the limit of the string's sounding-length, but Porphyry may have intended the implication that it is made of horn; cf. 121.23, 122.16 above.

⁷³⁹ This is a little misleading. When the diagonal bridge AZE is shifted, it divides AC as well as BD, so that the former will no longer be used 'as a whole'; and the relation between the notes of the two strings will always be an octave, whether or not the bridge cuts BD in half.

- κατὰ τοὺς οἰκείους λόγους, καθ' ὥς καὶ δεδήλωται. ἀπὸ γὰρ τῶν τομῶν τῆς κάτω πλευρᾶς μετὰ τῆς προστεθείσης ἴσης τὰς κατὰ τὸ ὀρθὸν ἰστα-
 μένας καταμετρήσει τις, οἷον ὥς ἡ ΕΓ πρὸς τὴν ΕΔ, οὕτως ἡ ΓΑ πρὸς
 τὴν ΔΖ· ὡσαύτως καὶ ὥς ἡ ὅλη ΕΓ πρὸς τὴν ΓΗ, τετραπλασίως γάρ,
 (25) οὕτως ἡ ΑΓ πρὸς τὴν ΑΚ· δις γὰρ διὰ πασῶν <ἀποτελεῖται καὶ ὥς ἡ
 (25a) ΓΑ πρὸς τὴν ΖΟΔ, οὕτως ἐστὶν ἡ ΞΓ πρὸς τὴν ΟΔ> καταβιβασθέντος τοῦ
 ὑπαγωγέως ἀπὸ τοῦ Α ἐπὶ τὸ Ξ.

ἔχει δ' ὁ μὲν

**πρῶτος τρόπος παρὰ τοῦτον προχειρότερον τὸ μὴ δεῖν κινεῖν τὰς ἀπ'
 ἀλλήλων διαστάσεις τῶν χορδῶν [25]**

- (28) Μεθ' ὃ ἔδειξε καὶ ἐπὶ τῶν δύο τρόπων τῶν ὀργάνων, πῶς αἱ συμφωνίαι
 συνάγονται, τὰς διαφορὰς τούτων τὰς πρὸς ἀλλήλους ἀποδίδωσι. προ-
 χειρότερον μὲν γὰρ παρὰ τοῦτον ἐκεῖνος ἔχει φησίν, ὅτι οὐ κινεῖ τὰς ἀπ'
 (30) ἀλλήλων διαστάσεις τῶν χορδῶν, ἀλλὰ τὴν αὐτὴν καὶ μίαν τῷ μήκει
 χορδὴν διὰ μικρῶν τινων ὑπαγωγιδίων διάφορον κατὰ τοὺς φθόγους
 καθιστᾷ, ὥς ποτὲ μὲν ἔχειν φέρε εἰπεῖν αὐτοὺς λόγον διπλασίονα, ποτὲ
 δ' ἐπὶ γ', ποτὲ δ' ἡμιόλιον.
- (160) οὗτος δὲ παρ' ἐκείνον τό τε κοινὸν [25]
 ἔχειν ὑπαγωγέα καὶ ἓνα καὶ κατὰ μίαν θέσιν καὶ ἔτι τὸ δύνασθαι
 καταβιβάζομενον αὐτὸν διὰ τοῦ Ε, ὥς ἐπὶ τὴν ΞΟΕ θέσιν ὀξύτερον
 ποιεῖν ὅλον τὸν τόνον, μενούσης τῆς κατὰ γένος ιδιότητος. ἐπεὶ καὶ
 ὥς ἡ ΓΑ φέρε εἰπεῖν πρὸς τὴν ΖΟΔ, οὕτως ἐστὶν ἡ ΞΓ πρὸς τὴν ΟΔ,
 καὶ ἐπὶ τῶν ἄλλων ὁμοίως. πάλιν τ' αὖ κατασκελέστερον ὁ μὲν πρότερος [30]
 ἔχει τρόπος παρὰ τοῦτον τὸ πλέονα δεῖν κινεῖν ὑπαγωγίδια καθ' ἑκά-
 [49] στην ἀρμογὴν, οὗτος δὲ παρ' ἐκείνον τὸ τὰς χορδὰς ὅλως παραφέρειν,

22 προστεθείσης p 23 ΓΑ] ΓΔ p
 τὴν ΟΔ> ex. gr. add Alexanderson

25 ΑΚ Alexanderson ΔΟ codd.
 26 Ξ scripsi E codd.

25 <ἀποτελεῖται – 25a

between the genera in correspondence with the appropriate ratios, as has been explained. For one will measure them along a straight line, from the divisions of the lower edge taken together with the equal addition;⁷⁴⁰ for instance, as EC is to ED, so is CA to DZ. And similarly, as the whole EC is to CH, which is quadruple, | so is AC to LK, for it produces the double octave; and as CA is to ZOD, so is XC to OD, when the bridge has been shifted down from A to X.⁷⁴¹

The first method is easier to apply than this one in that it is not necessary to alter the distances between the strings. Ptol. *Harm.* 48.23–5

After showing how the concords are constructed on the two types of instrument,⁷⁴² Ptolemy explains the differences between them. | He says that the other one is easier than this one, since it does not alter the distances between the strings; instead, it causes the same string with the same length to be different <in length> in correspondence with the notes, through the use of little bridges (*hypagōgidia*), | so that the notes are sometimes, for instance, in double ratio, sometimes in epitritic and sometimes in hemiolic.

But this one is easier than the other in that it has a common bridge, which is single and in a single position, and further in that it is possible to move the bridge down, pivoting on E, to the position of XO_E, and so to make the whole pitch higher, while the special character of the genus remains unchanged. For as CA, for instance, is to ZOD, so is XC to OD, and similarly for the others. Again, let us repeat, the former method is at a disadvantage by comparison with this one, in that there one has to move several little bridges (*hypagōgidia*) to accommodate each attunement, while this one is at a disadvantage by comparison with the other in that here one has to move the strings to completely new positions, and the changes [160D]

⁷⁴⁰ That is, the measurements will be taken along the length CE (the 'lower edge' CD plus the equal extension DE); what one measures is the distance between E and the point at which each string is placed. The ratio between any two of these distances will be the same as that between the sounding-lengths of the relevant strings (i.e. their lengths from their origins on CD to the points where they meet the bridge EA).

⁷⁴¹ The text of this sentence (159.24–6) is defective; there must be a lacuna after 'so is AC to', at which point the MSS jump to 'OD, when the bridge has been shifted . . . ' (The MSS also have 'from A to E' at the end of the sentence; but the E should clearly be X.) To fill the lacuna I print and translate the supplement suggested by Alexanderson, which must at least be on the right lines. (We may note, however, that its content relates to propositions that do not appear until the passage quoted in the last lemma of Porphyry's chapter.) What the first clause (down to 'so is AC to LK') says is correct (cf. Ptol. *Harm.* 47.16–17 and Porph. 159.24), even though Ptolemy, when speaking of this instrument, gives us no licence to measure any distance along CE except from a starting-point at E, whereas here we are asked to compare EC with CH. This poses no real problem; since EH is three quarters of EC, CH must be a quarter of EC.

⁷⁴² The two types are the one described in the present chapter and the eight-stringed *kanōn* discussed in I.11.

καὶ μηκέτι κατ' ἴσας αὐτῶν διαστάσεις, ἀλλὰ πολλαχῇ μακρῶ διαφερούσας συντελεῖσθαι τὰς τῶν ἐπιψάσεων μεταβάσεις.

- (2) Ὅτι τὰς χορδὰς ἐξαλλάσσει κατὰ τὸ μήκος διὰ τοῦ κοινοῦ αὐτοῦ ὑπαγωγέως, καὶ κινοῦνται αἱ διαστάσεις τῶν χορδῶν, καθ' ἃς οἱ φθόγγοι διαφέρουσι. τριχῶς γάρ, ὡς εἴρηται, διαφέρουσιν ἡ τῇ περιοχῇ, καθ' ἣν
- (5) παχύτερα ἢ λεπτοτέρα ἡ χορδὴ ἐστὶ σφωζομένης πάντως καὶ τῆς αὐτῆς διαστάσεως καὶ τῆς αὐτῆς τάσεως, ἢ τῇ τάσει, καθ' ἣν ἡ μὲν κατ' ἐπίτασιν τείνεται, ἡ δὲ κατ' ἄνεσιν σφωζομένων δηλονότι τῶν ἄλλων, ἢ τῇ διαστάσει, καθ' ἣν ἡ μὲν μακροτέρα, ἡ δὲ βραχυτέρα σφωζομένων τῶν ἄλλων τῶν αὐτῶν. ἐνταῦθα τοίνυν κατὰ τὴν διάστασιν ἢ διαφορὰ τῶν
- (10) φθόγγων ἐστίν· προχειρότερον οὖν ἐν πᾶσι τὸ ὄν τοῦ γινομένου. οὐ μὴν δ', ἀλλὰ καὶ οὗτος ὁ τρόπος πρόχειρον ἔχει, ὅτι οὐ πολλῶν χρήζει τῶν ὑπαγωγιδίων, ἀλλ' εἰς ἀρκεῖ κοινὸς ἐν τῇ μεταβάσει αὐτοῦ τὴν διαφορὰν τῶν φθόγγων ἀπεργάζεσθαι. δύναται γὰρ καταβιβάζεσθαι καὶ ποιεῖν τὸν φθόγγον ὀξύτερον μενούσης τῆς ιδιότητος τοῦ γένους, κἂν χρωματικὸν φέρε ἢ, κἂν διάτονον, κἂν ἐναρμόνιον. οὐδὲ γὰρ ὁ ταύτης μὲν τῆς χορδῆς φθόγγος ἀλλάσσεται, ἐκείνης δ' οὐ, ἀλλ' ἅμα πᾶσαι καὶ αἱ χορδαὶ καὶ οἱ φθόγγοι ἀλλάσσονται διὰ τοῦ ὑπαγωγέως.
- (15)

Υ'

Τὰ μὲν οὖν περὶ τὰς συμφωνίας καὶ τὰς ἐμμελείας τῶν κατὰ τὸ ἀπόψαλμα κειμένων φθόγγων θεωρούμενα μέχρι τοσούτων ἡμῖν ὑποτε- [5] τυπώσθω, συνεκλαμβανομένων τοῖς συμφώνοις καὶ τῶν ὁμοφωνιῶν.

in the points of contact are brought about no longer with equal distances (*diastaseis*) between the strings, but often with distances that differ by a large amount. Ptol. *Harm.* 48.25–49.3

<He says this> because he changes the strings' lengths by means of the common bridge, and the lengths of the strings,⁷⁴³ in correspondence with which the notes differ, are altered. For they differ in three ways, as we have said:⁷⁴⁴ in circumference, in so far as | the string is thicker or thinner while keeping exactly the same length and the same tension; in tension, in so far as one string is stretched more tightly and another more slackly, while the other factors, of course, are kept constant; and in length, in so far as one is longer and another shorter while the other factors are kept constant. In this case, then, the difference between the notes is | in correspondence with length. Now in all cases, what exists is easier than what is coming into existence;⁷⁴⁵ and not only that, but this method is also easy in that it does not need several little bridges, but one common bridge is sufficient to produce the difference between the notes, by changing its position. For it can move downwards and make the note higher while the characteristic quality of the genus is preserved, whether it is chromatic, | for instance, or diatonic or enharmonic. For it is not the case that the note of one string is altered while that of another is not, but all the strings and all the notes are altered at the same time by means of the bridge.

Chapter 3

Let that be our outline of the theoretical issues concerning the concordant and melodic relations between notes that are established in correspondence with the *apopsalma*, the homophones being included along with the

⁷⁴³ In this context 'the *diastaseis* of the strings' might be read as meaning 'the distances between the strings', as at the end of the preceding lemma. But it turns out that Porphyry says nothing here about changing an attunement by shifting the strings sideways (a strange omission, since this is one of the most remarkable characteristics of the way this instrument is operated; cf. *Harm.* 81.5–21); and elsewhere in this paragraph the noun *diastasis* always refers unambiguously to a string's length. Here, as often elsewhere in the commentary from I.9 onwards, Porphyry focuses on just one aspect of Ptolemy's discussion, in this case the use of the pivoting diagonal ('common') bridge.

⁷⁴⁴ See 133.30–4 above.

⁷⁴⁵ Throughout this passage, 'easy' translates *procheiros*, literally 'in front of the hand', and hence 'easily accessible' and 'easy to use'. Porphyry seems to mean that things already in existence are always 'easier' in this sense than things that are only in the process of coming into being. When a string's pitch is changed by altering its sounding-length, the new length already exists on the string and is therefore easy to access. In order to alter the tension, by contrast, we have to produce something that is not already present, by turning the tuning-peg; and to change the thickness while holding other factors constant, we shall have to look for another string with the right characteristics, and substitute it for the original one, checking its length and adjusting its tension to conform to those that had previously characterised the original.

συνεχοῦς δὲ τούτοις ὄντος τοῦ περὶ τῶν συστημάτων λόγου, προδιοριστέον τὰς κατὰ τὸ καλούμενον εἶδος τῶν πρώτων συμφωνιῶν διαφορὰς ἐχούσας οὕτως. εἶδος μὲν τοίνυν ἐστὶ ποία θέσις τῶν καθ' ἑκαστον γένος ἰδιαζόντων ἐν τοῖς οἰκείοις ὁροις λόγων. εἶεν δ' ἂν οὗτοι [10] τοῦ μὲν διὰ πέντε καὶ τοῦ διὰ πασῶν οἱ τονιαῖοι καὶ διαζευκτικοί, τοῦ δὲ διὰ τεσσάρων οἱ τῶν ἡγουμένων δύο φθόγγων, οἵτινες ποιοῦσι τὰς ἐπὶ τὸ μαλακώτερον ἢ τὸ συντονώτερον παραλλαγὰς. πρῶτον μὲν οὖν καλοῦμεν εἶδος κοινῶς, ὅταν ὁ ἰδιάζων λόγος τὸν ἡγούμενον ἐπέχη τόπον, ὅτι καὶ τὸ ἡγούμενον πρῶτον, δεύτερον δέ, ὅταν τὸν δεύτερον [15] ἀπὸ τοῦ ἡγουμένου, καὶ τρίτον, ὅταν τὸν τρίτον καὶ κατὰ τὸ ἐξῆς οὕτως. διὸ καὶ τσαῦτα ἐστὶν εἶδη καθ' ἑκαστον, ὅσοι καὶ τόποι τῶν λόγων, τοῦ μὲν διὰ τεσσάρων τρία, τοῦ δὲ διὰ πέντε τέσσαρα, τοῦ δὲ διὰ πασῶν ἑπτὰ.

- (20) Ἀνακεφαλαιούμενος τὰ πρότερα τὸν ἴδιον τρόπον σαφηνείας ἔνεκα καὶ ταῦτά φησιν· ἐπεὶ δὲ τῶν φθόγγων οἱ μὲν εὐφοροὶ μόνον ἐμμελεῖς, οἱ δὲ μετέχοντες καὶ ὁμοιότητός τινος σύμφωνοι, οἱ δ' ὁμοιότητος ὁμόφωνοι, οἱ δὴ καὶ ἀντίφωνοι λέγονται. καὶ εἴ τις ὁμόφωνος, κάκεῖνος πάντως καὶ σύμφωνος καὶ ἐμμελής, εἴ τις δὲ σύμφωνος καὶ ἐμμελής, οὐ πάντως ὁμόφωνος· ὁ δ' ἐμμελής οὔτε σύμφωνος, οὔθ' ὁμόφωνος. κατὰ τοῦτον τὸν λόγον καὶ αἱ ἐμμέλεια καὶ αἱ συμφωνίαι καὶ αἱ ὁμοφωνίαι συνίστανται κατὰ τὰ ἀποφάγματα τῶν ὀργάνων, ὅπου ἄρα καὶ αἱ φωναὶ
- (25) ἀποδιδούσι. ὁμόφωνα δ' ἰδίως ὁ Πτολεμαῖος τὸ διὰ πασῶν καὶ τὸ δις διὰ πασῶν καὶ τὸ τρίς ἴσως διὰ πασῶν καὶ τετράκις κατὰ Πλάτωνά φησιν. σύμφωνα δὲ τὸ διὰ τεσσάρων καὶ τὸ διὰ πέντε, ὁμοίως δὲ καὶ τὰ συγκείμενα ἔκ τε τούτων καὶ τῶν ὁμοφώνων, ὡς τὸ διὰ πασῶν καὶ διὰ τεσσάρων καὶ τὸ διὰ πασῶν καὶ διὰ πέντε τέως δ' ἐπὶ πάντων τῶν τε συμφώνων καὶ ὁμοφώνων τὰ αὐτά, ἅπερ πρότερον εἴρηκεν ἐν τῷ δευτέρῳ κεφαλαίῳ, κρατοῦσιν.
- (5) Ἐπεὶ δὲ περὶ τοῦ συστήματος ἔμελλε λέγειν, ὃ δὴ ἐκ τῶν διαστημάτων ἦ τριῶν, ὡς ἐπὶ τοῦ διὰ τεσσάρων, ἢ τεσσάρων, ὡς ἐπὶ τοῦ διὰ πέντε, ἢ

23 ἀντίφωνοι Düring ἀντίφθογγοι coddl.

27 δτου G

1 ἀποδιδούσι] ἀποδίδονται conl. Düring

concorde. The next topic for discussion after these is that dealing with the *systemata*, but first we must define the differences between the first concords in respect of what is called 'form'. They are as follows. A form is a particular positioning of the ratios which, when they lie between the appropriate boundaries, are peculiar to each genus. In the fifth and the octave these will be the disjunctive tones, while in the fourth they will be the ratios between the two leading notes, the ratios that create variations in the direction of greater softness or tenseness. Thus we call it the first form in all cases when the peculiar ratio holds the leading place, since what leads is first; the second when it holds the second place, next after the leading one; the third when it holds the third place, and so on in order. Hence in each case there are as many forms as there are places belonging to the ratios, three in the fourth, four in the fifth and seven in the octave. Ptol. *Harm.* 49.4–19

| While summing up points he made earlier, in his characteristic way, for the sake of clarity, Ptolemy says this too.⁷⁴⁶ Since those of the notes⁷⁴⁷ that are merely agreeable are melodic, those that are also to some extent similar are concordant, and those that are similar are homophones, which people also call *antiphōnoi*⁷⁴⁸ – and any that is a homophone is always also concordant and melodic, while any that is a concord is also melodic but not | always a homophone, and a melodic is neither concordant nor a homophone – by this account the melodics and the concords and the homophones are all established in accordance with the *apopsalmata* of the instruments, the places where they produce the sounds.⁷⁴⁹ Ptolemy gives the special name [161D] 'homophone' to the octave and the double octave (and perhaps, as Plato has it, the triple and the quadruple octave too);⁷⁵⁰ he calls the fourth and the fifth 'concordant', as he does, similarly, the ones composed from them and the homophones, for instance the octave and | a fourth and the octave and a fifth; and the same principles that he expounded in the second chapter govern all the concords and homophones.

Since he is going to talk about the *systema*,⁷⁵¹ which is composed of three intervals in the case of the fourth, or four in the case of the fifth,

⁷⁴⁶ I take 'this' to point forward to the sequel, not backwards to what is said in the lemma. For the statements that follow cf. Ptol. *Harm.* 10.23–8, 15.3–17, Porphy. 113.17–26.

⁷⁴⁷ Strictly speaking, Porphyry should have written 'those pairs of notes' or 'those intervals'.

⁷⁴⁸ For this usage see 104.9–10 above with n. 467.

⁷⁴⁹ Cf. n. 736 above. In the passage quoted in the lemma Ptolemy is probably using the noun *apopsalma* to refer to a string's sounding-length, not the point forming the limit of that length, and Porphyry, I think, adopts the same usage here.

⁷⁵⁰ The allusion is to the attunement of the World Soul at *Timaeus* 35b–36b, which spans four octaves and a major sixth; Porphyry also mentions it at 115.27–116.1, 163.6–7. Cf. Theo Smyrn. 63.25–65.7.

⁷⁵¹ The noun *systema*, in musical contexts, can usually be translated fairly accurately as 'scale'; a *systema* need not cover a whole octave or series of octaves, but the term's application is often restricted, as it is by Ptolemy, to sequences whose boundaries form a concord. In standard usage it can have a compass as small as a perfect fourth, and Aristoxenus occasionally uses it of even smaller sequences.

- (10) ἑπτὰ, ὡς ἐπὶ τοῦ διὰ πασῶν, καὶ ἐπέκεινα συνέστηκε, πρῶται δὲ συμφωνίαι εἰσὶ καὶ ἀρχοειδέστεραι τὸ διὰ τεσσάρων, τὸ διὰ πέντε καὶ τὸ διὰ πασῶν, πρὸ ἐκείνου διορίζεται τὰ εἶδη τῶν τοιούτων ἐν τῷ ὄργάνῳ, πόσα τε καὶ τίνα εἰσὶ. καὶ ἐκτίθησι πρῶτον τετράχορδον διὰ τεσσάρων ἀπὸ ὑπάτης, τὸ ΑΒΓΔ, τοῦ Α κατὰ τὸν ὀξύτατον τόπον κειμένον· εἴτα
- (15) δεύτερον διὰ τεσσάρων, τὸ ΔΕΖΗ· εἴτα τόνον τὸ ΗΘ, ὃς καὶ διαζευκτικός λέγεται. διαζευγνύουσι γὰρ τὰ τέσσαρα τετράχορδα τοῦ δις διὰ πασῶν ἔνθεν μὲν τὰ δύο, ἐκείθεν δὲ τὰ δύο· εἴτ' αὐθις ἄλλο τετράχορδον διὰ τεσσάρων τὸ ΘΚΛΜ καὶ αὐθις ἄλλο τὸ ΜΝΞΟ. καὶ οὕτως ἐκ τοῦ Ο ἀρχόμενος τοῦ βαρυτέρου τόπου εὐρίσκει εἶδη τοῦ μὲν διὰ τεσσάρων
- (20) τρία, ἃ δὴ οὐ φθάνουσι μέχρι τοῦ διαζευκτικοῦ τόνου, τοῦ δὲ διὰ πέντε τέσσαρα, τοῦ δὲ διὰ πασῶν ἑπτὰ, κατὰ τὸν ἀριθμὸν τῶν διαστημάτων αὐτῶν.

- Ἐπεὶ τοίνυν εἶδος ἐστὶ ποιά θέσις τῶν καθ' ἕκαστον γένος—διatonικόν φημι, χρωματικόν καὶ ἐναρμόνιον—ἰδιαζόντων ἐν τοῖς οἰκείοις
- (25) ὅροις—ταῦτόν δ' εἰπεῖν φθόγγοις καὶ τόνοις—λόγων, ἄλλη γὰρ ἡ παρανήτη ἢ ἡ λιχανὸς τοῦ διατόνου φέρε καὶ ἄλλη τοῦ χρωματικοῦ καὶ τούτου ἄλλη τοῦ μαλακοῦ καὶ ἄλλη τοῦ συντόνου καὶ ἄλλη τοῦ ἐναρμονίου, οἱ μὲν τοῦ διὰ πέντε καὶ τοῦ διὰ πασῶν λόγοι εἶεν ἂν οἱ τονιαῖοι καὶ διαζευκτικοί· σφάζουσι γὰρ τὰ αὐτῶν εἶδη μέχρι καὶ αὐτοῦ τοῦ διαζευκτικοῦ
- (30) τόνου, ὅθεν ἀρχονται καὶ εἰς ὃν καταλήγουσιν· οἱ δὲ τοῦ διὰ τεσσάρων

or | seven in the case of the octave, and <can extend> even beyond that, while the first and most fundamental concords are the fourth, the fifth and the octave, as a preliminary to this he specifies how many forms of such things there are on an instrument,⁷⁵² and which they are. He sets out a first tetrachord, spanning a fourth beginning from *hypatē*,⁷⁵³ ABCD, with A in the highest position; then | a second tetrachord, DEZH; then a tone, HF, which is called 'disjunctive' because people disjoin the four tetrachords of the double octave by putting two of them below it and two above; then again another tetrachord spanning a fourth, FKLM, and again another, MNXO. And in this way, beginning the lower region from O, he finds three forms | of the fourth, which do not extend to the disjunctive tone, four of the fifth and seven of the octave, corresponding to the number of intervals that each contains.

Since, then, a form is a particular positioning of the ratios which are peculiar to each genus (I mean diatonic, chromatic and enharmonic) when they lie between the appropriate | boundaries (that is to say, the notes and pitches) – for the *paranētē* or the *lichanos* of the diatonic, for instance, is different from that of the chromatic, and that of the soft chromatic is different from that of the tense chromatic and from that of the enharmonic – the <relevant> ratios of the fifth and the octave will be the disjunctive tones; for they extend their forms to include the disjunctive | tone itself, from which they begin and in which they end. Those of the fourth will be

⁷⁵² 'Forms' translates *eidē*; an alternative rendering is 'species', but this suggests a relation between species and genera which is not appropriate here. Sometimes elsewhere these forms are called *schēmata*, 'shapes' or 'arrangements'. Ptolemy says nothing about instruments in this connection, but Porphyry is thinking in concrete terms, of the ways in which the ratios or intervals of a *systema* can be arranged on the strings of an instrument when it is tuned.

⁷⁵³ The MSS reading, *hypatē*, might seem to be a mistake. Porphyry is faithfully following Ptolemy's presentation at *Harm.* 49.22–6 (which he does not quote until the next lemma), in which A is the highest note of this tetrachord, and the rest of the system continues downwards from D. But each of the two notes named *hypatē* (*hypatē mesōn* and *hypatē hypatōn*) is in the lower half of the two-octave system, so that the sequence cannot extend downwards from a tetrachord containing either of them through the full two octaves which Porphyry and Ptolemy describe. One would therefore expect the note mentioned here to be the highest of the system, *nētē hyperbolaiōn*, and this would correspond to A. But the reading *hypatē* can be defended, since at least for his purposes in Book II, Ptolemy does not conceive the system as a linear sequence with a beginning and an end; it is a circle, in which the 'lowest' note, *proslambanomenos*, is identical (so far as its melodic function is concerned) with the 'highest', *nētē hyperbolaiōn* (see *Harm.* II.5, especially 52.19–21, 53.13–15, cf. *Porph.* 167.28–30). Then if A is the highest note of the tetrachord, and D, the lowest, is equated with *hypatē mesōn* (so that A is *mesē*), we can proceed downwards from it through the conjoined tetrachord *hypatōn*, then through a tone to *proslambanomenos* = *nētē hyperbolaiōn*, and then through two more conjoined tetrachords (*hyperbolaiōn* and *diezeugmenōn*), exactly as Porphyry says. I am not sure, however, that Porphyry reasoned in this way; his comment at 167.28–30 leaves room for doubt that he had really understood Ptolemy's position.

εἶεν ἂν οἱ τῶν ἡγουμένων δύο φθόγγων λόγοι. πᾶς γὰρ φθόγγος τῷ συνεχεῖ αὐτοῦ φθόγγῳ διάφωνός ἐστιν, ὅμως γε μέντοι τῇ μίξει τῶν δύο φθόγγων ἢ εὐφορός τις ἤχῳ ταῖς ἀκοαῖς ἀποτελεῖται καὶ ἔστιν ἐμμελής, ἢ τραχὺς καὶ ἀποκναίων καὶ ἔστιν ἐκμελής.

- (162) καὶ δὴ συμβέβηκε τοῦ μὲν διὰ τεσσάρων ἐν εἶδος μόνον, τὸ πρῶτον, ὑφ' ἐστῶτων περιέχεσθαι φθόγγων, τοῦ δὲ διὰ πέντε δύο μόνα, [20] τὸ τε πρῶτον καὶ τὸ τέταρτον, τοῦ δὲ διὰ πασῶν τρία μόνα, τὸ τε πρῶτον καὶ τὸ τέταρτον καὶ τὸ ἕβδομον. ἐάν γὰρ ἐκθώμεθα διὰ τεσσάρων τὸ ΑΒΓΔ, τοῦ Α κατὰ τὸν ὀξύτατον φθόγγον νοούμενου, καὶ τούτῳ συνάψωμεν ἕτερον ἐπὶ τὸ βαρὺ διὰ τεσσάρων ὁμοίως ἔχον τὸ ΔΕΖΗ καὶ τούτῳ τόνον ὁμοίως τὸν ΗΘ καὶ πάλιν αὐτῷ τούτῳ μὲν διὰ τεσσάρων [25] τὸ ΘΚΛΜ, τοῦτῳ δὲ ἕτερον διὰ τεσσάρων τὸ ΜΝΞΟ, ἐστῶτες μὲν ἔσονται τῶν φθόγγων οἱ Α καὶ Δ καὶ Η καὶ Θ καὶ Μ καὶ Ο, τοῦ δὲ [50] διὰ τεσσάρων πρῶτον μὲν εἶδος τὸ ΜΟ, δεύτερον δὲ τὸ ΛΞ, τρίτον δὲ τὸ ΚΝ, καὶ μόνον ὑφ' ἐστῶτων φθόγγων δηλονότι περιεχόμενον τὸ ΜΟ καὶ πρῶτον. τοῦ δὲ διὰ πέντε πρῶτον μὲν εἶδος ἔσται τὸ ΗΜ, δεύτερον δὲ τὸ ΖΛ, τρίτον δὲ τὸ ΕΚ, τέταρτον δὲ τὸ ΔΘ, καὶ μόνα δηλονότι τούτων ὑφ' ἐστῶτων φθόγγων περιεχόμενα τὸ τε ΗΜ πρῶτον καὶ τὸ [5]

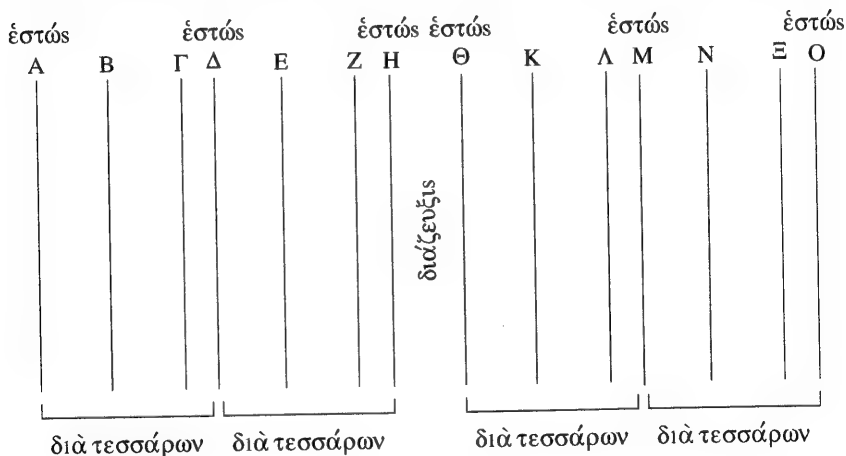


Figure 12G

the ratios between the two leading notes.⁷⁵⁴ For every note is discordant with the note next to it, but nevertheless, either an agreeable sound is produced by the mixture of the two notes and it is melodic, or a rough and grating sound and it is unmelodic.⁷⁵⁵

Now it turns out that there is only one form of the fourth that is bounded by fixed notes (it is the first form), only two of the fifth (the first and fourth forms), and only three of the octave (the first, fourth and seventh forms). For if we set out a fourth ABCD, treating A as the highest note, and conjoin with it another similar fourth below, DEZH, then conjoin with this in the same way a tone, HF, conjoin with this, once again, a fourth FKLM, and with that another fourth MNXO, then of the notes the fixed ones will be A, D, H, F, M and O. The first form of the fourth will be MO, the second LX and the third KN, and it is clear that only MO, the first, is bounded by fixed notes. Of the fifth, the first form will be HM, the second ZL, the third EK and the fourth DF, and it is clear that of these only HM, the first, and DF,

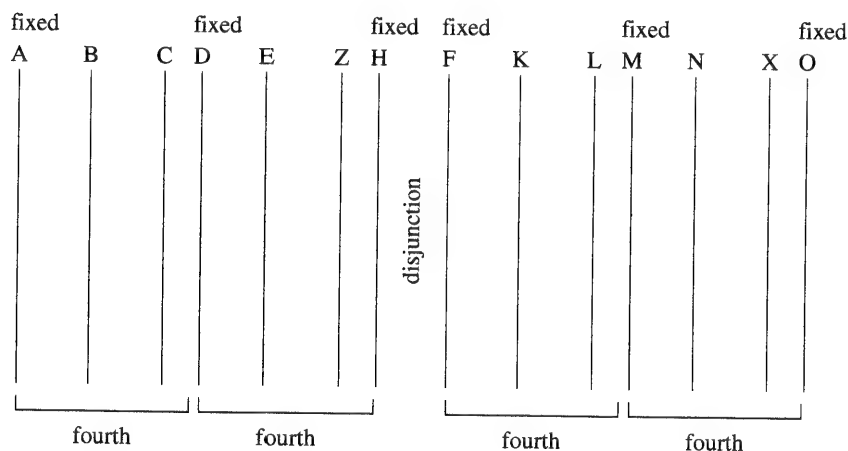


Figure 12

⁷⁵⁴ To clarify: the forms of each *systema* are numbered in accordance with the position of one of its ratios or intervals; in the 'first' form this interval is in the highest position, in the second it is in the second-highest position, and so on. In the case of *systemata* spanning a fourth it is the interval most responsible for giving the genus its character, the one that lies at the top of the tetrachord in the basic constructions presented in Book I, such as the interval between *mesē* and *lichanos*. Both the fifth and the octave always contain one of the tones by which tetrachords are disjoined, and in their case this tone is the interval used for this purpose.

⁷⁵⁵ Why Porphyry inserts this comment here is obscure, though it harks back to his remarks at the beginning of the passage. By a 'mixture' (*mixis*) he presumably means a sequence rather than the result of their being sounded simultaneously (which in these cases would always be 'rough and grating'), though more commonly a *mixis* is the latter and a sequence is usually called a *synthesis*.

ΔΘ τέταρτον. καὶ τοῦ διὰ πασῶν πρῶτον μὲν εἶδος ἴσται τὸ **ΗΟ**, δεύτερον δὲ τὸ **ΞΕ**, τρίτον δὲ τὸ **ΕΝ**, τέταρτον δὲ τὸ **ΔΜ**, πέμπτον δὲ τὸ **ΓΛ**, ἕκτον δὲ τὸ **ΒΚ**, ἑβδομον δὲ τὸ **ΑΘ**, μόνα δὲ καὶ τούτων πάλιν ὑφ' ἐστῶτων φθόγγων περιεχόμενα τὸ τε **ΗΟ** πρῶτον καὶ τὸ **ΔΜ** τέταρτον καὶ τὸ **ΑΘ** ἑβδομον. [10]

- (2) Τοῦ μὲν διὰ τεσσάρων εἰ ἀπὸ τοῦ **Ο** ἀρχῇ—καὶ γὰρ ἔξεστι καὶ ἀπὸ τοῦ **Α** ἀρχεσθαι καὶ τὰ αὐτὰ ποιεῖν—πρῶτον εἶδος τὸ **ΜΝΞΟ**, δεύτερον τὸ **ΛΜΝΞ**, τρίτον τὸ **ΚΛΜΝ**, ὧν τὸ πρῶτον μόνον χρήσιμόν ἐστιν, ὡς ὑφ' ἐστῶτων συνεχόμενον φθόγγων τοῦ τε **Ο** καὶ τοῦ **Μ**, τὰ δὲ δύο ἄχρηστα, ὡς ὑπὸ κινουμένων συνεχόμενα. ἔστι γὰρ τὸ πρῶτον τόνος, τόνος καὶ ἡμιτόνιον, καὶ ὁ ἡγούμενος εὐρίσκεται μείζων τοῦ ἐπομένου κατὰ τὸ εἰκός· τὸ δὲ δεύτερον τόνος, ἡμιτόνιον, τόνος, καὶ ἔστι τὸ μέσον διάστημα ἑλάττων τοῦ ἐπομένου· τὸ δὲ τρίτον ἡμιτόνιον, τόνος, τόνος, καὶ ἔστιν ἑλάττων ὁ ἡγούμενος. καὶ ταῦτα μὲν τὰ τοῦ διὰ τεσσάρων εἶδη.
- (10) Τὰ δὲ τοῦ διὰ πέντε πρῶτον τὸ **ΗΜ**· ἔστι γὰρ τόνος, τόνος καὶ ἡμιτόνιον τὸ τετράχορδον καὶ ἐπὶ τούτοις ὁ διαζευκτικός τόνος καὶ συνεχεται ὑφ' ἐστῶτων φθόγγων τοῦ **Η** καὶ **Μ** καὶ ἔστι χρήσιμον τῇ μελωδίᾳ· δεύτερον τὸ συνεχές **ΖΛ**· περιέχεται δ' ὑπὸ κινουμένων καὶ ἔστιν ἄχρηστον· τρίτον τὸ **ΕΚ** καὶ αὐτὸ ὁμοίως ὑπὸ κινουμένων περιεχόμενον καὶ ἄχρηστον· τέταρτον τὸ **ΔΘ** ὑφ' ἐστῶτων περιεχόμενον καὶ τῇ μελωδίᾳ χρήσιμον· ἔστι γὰρ τόνος, τόνος, τόνος καὶ ἡμιτόνιον.
- Ὅμοιως καὶ τὰ τοῦ διὰ πασῶν εἶδη· πρῶτον τὸ **ΗΟ** συλλαμβανόμενον κἂν τούτοις τοῦ διαζευκτικοῦ τόνου, ὅπερ συνεχόμενον ὑφ' ἐστῶτων φθόγγων χρήσιμόν ἐστιν· δεύτερον τὸ **ΞΕ**, ὅπερ ὑπὸ κινουμένων συνεχόμενον ἄχρηστόν ἐστι· τρίτον τὸ **ΕΝ** καὶ αὐτὸ ὑπὸ κινουμένων καὶ ἄχρηστον· τέταρτον τὸ **ΔΜ** ὑφ' ἐστῶτων περιεχόμενον φθόγγων καὶ χρήσιμον· πέμπτον τὸ **ΓΛ** ὑπὸ κινουμένων περιεχόμενον καὶ ἄχρηστον· ἕκτον τὸ **ΒΚ** καὶ αὐτὸ ἄχρηστον· ἑβδομον τὸ **ΑΘ**, ὅπερ καὶ αὐτὸ ὑφ' ἐστῶτων συνεχεται καὶ χρήσιμόν ἐστι. πλὴν ἰστέον, ὅτι κἂν ἄλλ' ἄττα καταλαμβάνονται ἐν τῷ ἀμεταβόλῳ τοῦ <δῖς> διὰ πασῶν συστήματι,
- (15) (20) (25)

the fourth, are bounded by fixed notes. Of the octave, the first form will be HO, the second ZX, the third EN, the fourth DM, the fifth CL, the sixth BK and the seventh AF, and of these, once again, only HO, the first, DM, the fourth, and AF, the seventh, are bounded by fixed notes. Ptol. *Harm.* 49.19–50.10

If one begins from O (for it is possible also to begin from A and produce the same results), the first form of the fourth is MNXO, the second LMNX and the third KLMN, of which only the first is usable, contained as it is between | the fixed notes O and M, while the others are useless, contained as they are by movable notes.⁷⁵⁶ For the first form is tone, tone, half-tone, and the leading <ratio> is found to be greater than the 'following' <ratio>, as it should be. But the second is tone, half-tone, tone, and the middle interval is smaller than the 'following' one; and the third is half-tone, tone, tone, and | the leading <ratio> is smaller.⁷⁵⁷ These are the forms of the fourth.

The first form of the fifth is HM, for it is the tetrachord tone, tone, half-tone and in addition the disjunctive tone; it is contained between the fixed notes H and M, and it is usable in melody. The second is the one next to it, ZL; it is contained by movable notes | and is useless. The third, EK, is similarly contained by movable notes and is useless. The fourth, DE, is contained by fixed notes and is usable in melody, for it is tone, tone, tone, half-tone.

In the forms of the octave, similarly, the first is HO, in which the disjunctive tone is again included, which is contained between fixed | notes and hence is usable. The second is ZX, which is contained by movable notes and hence is useless; the third, EN, is again bounded by movable notes and hence is useless; the fourth, DM, is bounded by fixed notes and hence is useful; the fifth, CL, is bounded by movable notes and hence is useless; the sixth, BK, is also useless; and the seventh is AF, which again | is contained by fixed notes and is useful. But we must realise that even if certain others are included in the un-modulated system of the double

⁷⁵⁶ 'Usable' and 'useless' are not terms that Ptolemy applies in this context. While tetrachords falling between movable notes do not conform to the principles laid down in Book I, as Porphyry's next comments show, they are nevertheless perfectly good harmonic sequences. They will of course appear in any scale spanning more than a perfect fourth, and the forms of the octave which Porphyry describes as 'useless' in the same way play significant roles in Ptolemy's theory of the *tonoi*.

⁷⁵⁷ I supply 'ratio' in the statements about the first and third forms, since the participles ('leading' and 'following') are masculine; no noun appears, but it must be *logos*. In the statement about the second form the text includes the neuter noun *diastēma* ('interval'), and the words 'middle' and 'following' are correspondingly neuter.

ἀλλ' οὖν κακείνα τὰ αὐτὰ εἰσι καὶ μηδὲν ἔχοντα παραλλαγὴν πρὸς ταῦτα.

δ'

Τούτων δὴ προεκτεθειμένων σύστημα μὲν ἀπλῶς καλεῖται τὸ συγκείμενον μέγεθος ἐκ συμφωνιῶν, <καθάπερ συμφωνία τὸ συγκείμενον μέγεθος ἐξ ἑμμελειῶν, καὶ ἔστιν ὥσπερ συμφωνία συμφωνιῶν τὸ σύστημα. τέλειον δὲ σύστημα λέγεται τὸ περιέχον πάσας τὰς συμφωνίας (15) μετὰ τῶν καθ' ἑκάστην εἰδῶν, ὅτι καὶ τέλειόν ἐστι καθόλου τὸ τὰ αὐτοῦ μέρη πάντα περιέχον. κατὰ μὲν οὖν τὸν πρῶτον ὅρον γίνεται σύστημα καὶ τὸ διὰ πασῶν—ἐδόκει γοῦν αὐταρκες εἶναι τοῦτο τοῖς παλαιοῖς—καὶ τὸ διὰ πασῶν καὶ διὰ τεσσάρων, καὶ τὸ διὰ πασῶν καὶ διὰ πέντε, καὶ τὸ δις διὰ πασῶν. ἕκαστον γὰρ αὐτῶν ὑπὸ συμφωνιῶν (20) περιέχεται δύο ἢ πλείονων. κατὰ δὲ τὸν δεύτερον μόνον ἂν εἴη τέλειον σύστημα τὸ δις διὰ πασῶν· μόνῳ γὰρ ἔνεστιν αὐτῷ τὰ σύμφωνα πάντα μετὰ τῶν ἐκκειμένων εἰδῶν. καὶ τὰ μὲν ὑπὲρ αὐτὸ πλέον οὐδὲν ἂν ἔχοι τῶν ἐν ἐκείνῳ δυνάμει λαμβανομένων, τὰ δ' ὑπ' αὐτὸ λείπειτ' ἂν [51] τισι τῶν ἐν ἐκείνῳ, ὅθεν τὸ συντιθέμενον ἐκ τοῦ διὰ πασῶν καὶ διὰ τεσσάρων σύστημα τέλειον οὐ καλῶς ἔχει καλεῖν. τὰ μὲν γὰρ ἑπτὰ εἶδη τοῦ διὰ πασῶν οὐδέποτε περιέξει>

- (31) Εἰσβάλλει λοιπὸν εἰπεῖν περὶ συστήματος, ὀρίζεται δ' αὐτὸ διττῶς. καὶ πρῶτον μὲν ἀπλῶς τὸ συγκείμενον μέγεθος ἐκ συμφωνιῶν, καθάπερ
- (163) ἡ συμφωνία ἐστὶ συγκείμενον μέγεθος ἐξ ἑμμελειῶν· συμφωνία γὰρ ἴσως τὸ διὰ τεσσάρων· ἑμμέλεια δὲ τὰ αὐτοῦ διαστήματα· ὁμοίως καὶ τὸ διὰ πέντε. σύστημα δὲ τὸ ἐξ αὐτῶν συγκείμενον δηλονότι τὸ διὰ πασῶν, ὃ δὴ καὶ οὐ συμφωνία κληθεῖη, ἀλλὰ συμφωνία συμφωνιῶν. ὁμοίως δὲ καὶ τὸ διὰ πασῶν καὶ διὰ τεσσάρων καὶ τὸ διὰ πασῶν καὶ διὰ πέντε καὶ τὸ δις διὰ πασῶν καὶ τὰ ἐπέκεινα τούτων, ἡγουν τὸ τρις καὶ
- (5)

27 τέλος τοῦ γ' κεφαλαίου· ἀρχὴ τοῦ δ' κεφαλαίου add. p

in lemmate: 50.13 καθάπερ — 51.3 περιέξει e Ptol. addidi

octave, they are nevertheless the same as these and in no way different from them.⁷⁵⁸

Chapter 4

With⁷⁵⁹ these points set out in advance, we may say that the name '*systema*', unqualified, | is given to a magnitude put together from concords, <just as a concord is a magnitude put together from melodics, and a *systema* is, as it were, a concord of concords. The name 'complete *systema*' is given to that which contains all the concords, together with the forms proper to each of them, since in general a thing is complete if it contains all its own parts. By the first definition the octave is a *systema* – and indeed this one was thought by the ancients to be self-sufficient – as are the octave and a fourth, the octave and a fifth, and the double octave. For each of them is bounded by two or more concords. By the second definition only the double octave can be a complete *systema*, for only in it are there all the concords, together with the forms that have been set out. Those greater than it will not contain any additional form beyond those capable of being found in this one, while those smaller than it will lack some of those that are in this one; and hence it is not correct to call 'complete' the *systema* put together out of the octave and a fourth. For it will never contain the seven forms of the octave... > Ptol. *Harm.* 50.12–51.3

Ptolemy embarks next on a discussion of the *systema*, and he defines it in two ways, first, unqualified, as a magnitude put together from concords, just as a concord is a magnitude put together from melodics. The fourth, for instance, is a concord, and its intervals are melodic; and the same goes for the fifth. The *systema* put together from them is of course the octave, and this was not called a concord but a concord of concords. The same | is true of the octave and a fourth, the octave and a fifth, the double octave and those extending beyond it, that is, the triple and quadruple octaves,

[163D]

⁷⁵⁸ 'Certain others': i.e. certain other organisations of intervals within the octave. Since there are no other octave scales of this diatonic type within the double octave, Porphyry is probably thinking of scales with intervals other than tones and (approximate) half-tones. His point will be that even though their intervals are different, the forms they take (marked by the position of the disjunctive tone) are the same, and the comments about fixed and movable bounding notes, and about the forms' usability and uselessness, will still apply. The 'un-modulated' or 'changeless' (*ametabolon*) system is the two-octave scale in its standard form, from *proslambanomenos* up to *nētē hyperbolaion*. The word 'double' (*dis*) is missing from the MSS but must surely be supplied; though sense could be made of the text as it stands, the adjective *ametabolos* is not used elsewhere of the octave, and the whole of this chapter's discussion has been set within the two-octave frame.

⁷⁵⁹ The lemmata in this and the subsequent chapters do not include the whole of Ptolemy's text, and though Porphyry paraphrases parts of the remainder in the course of his discussion, the paraphrases are loose and fragmented and still leave major omissions. I have therefore supplemented the lemmata so that they reproduce the whole of Ptolemy's text, with the added passages in brackets.

τετράκις διὰ πασῶν, καθάπερ ὁ Πλάτων φησίν· ἃ δὴ καὶ περίεργα τῷ Πτολεμαίῳ λογιζονται.

- Εἴτα καὶ τὸ τέλειον σύστημα ὀρίζεται τὸ λεῖπον ἐν μηδενί, ἐπεὶ καὶ
- (10) πανταχοῦ τοιοῦτον τὸ τέλειον. καὶ ἔστιν ὥς φησι τὸ δις διὰ πασῶν. τοῦτο γὰρ περιέχει, ὡς δείξει, μὴ μόνον τὰ στοιχειωδέστερα σύμφωνα, τὸ διὰ τεσσάρων καὶ διὰ πέντε καὶ τὸ ἐξ αὐτῶν διὰ πασῶν, ἀλλὰ καὶ τὰ τούτων ἅπαντα εἶδη καὶ τὰ ἐξ αὐτῶν συγκείμενα· ἃ δὴ τὰ μὲν ὑπ' αὐτὸ οὐκ ἔχει, τὰ δ' ὑπὲρ αὐτὸ οὐ πλέον ἔξει ἢ ταῦτα καὶ μόνον· διὸ καὶ
- (15) κυρίως καὶ τέλειον τὸ τοιοῦτο σύστημα, ὃ ὀριζόμενος λέγει τὸ περιέχον πάσας τὰς συμφωνίας μετὰ τῶν καθ' ἕκαστον εἰδῶν.

- Κατὰ γοῦν τὸν πρῶτον ὄρον πᾶσαι αἱ σύνθετοι συμφωνίαι συστήματα ἂν κληθεῖεν, εἰ καὶ τὸ διὰ τεσσάρων καὶ τὸ διὰ πέντε οὐκ ἂν ὅλως κληθεῖεν συστήματα ὡς στοιχειωδέστερα, ἐπεὶ τοί γε καὶ τοῖς παλαιοῖς
- (20) αὐταρκες ἔδοξε σύστημα τὸ διὰ πασῶν—οὕτω γὰρ εἰς τὸ τελειότερον προήχθη ἡ ἁρμονία ὡς συσταθῆναι τὸ δις διὰ πασῶν ἐν τελείᾳ μουσικῇ ἀριδηλότερον, καθ' ὡς συνέστη ὕστερον—πολλῷ δὲ μᾶλλον τὸ διὰ πασῶν καὶ διὰ πέντε καὶ τὸ διὰ πασῶν καὶ διὰ τεσσάρων· οὐ μὴν δ', ἀλλὰ καὶ αὐτὸ μᾶλλον τὸ δις διὰ πασῶν. ἕκαστον γὰρ αὐτῶν ὑπὸ συμφωνιῶν
- (25) περιέχεται· συμφωνίας δὲ λεκτέον τὸ τε διὰ τεσσάρων καὶ τὸ διὰ πέντε, ἐξ ὧν τὸ διὰ πασῶν συνίσταται, εἴθ' οὕτω τὰ λοιπὰ, ἃ δὴ καὶ ἐκ πλειόνων περιέχονται· τὸ γὰρ διὰ πασῶν καὶ διὰ τεσσάρων ἕκ τε τοῦ διὰ τεσσάρων καὶ διὰ πέντε καὶ διὰ τεσσάρων σύγκειται. οὗτος δὲ μόνον τὸ δις διὰ πασῶν ἐγκρίνει σύμφωνον συμφώνων καὶ τέλειον, ὅτι ἐν αὐτῷ

according to what Plato says;⁷⁶⁰ but those calculations are extraneous to Ptolemy's agenda.

He next defines the complete *systema* as that which is lacking in nothing, since this is | always the characteristic of what is complete. And as he says, it is the double octave. For it contains, as he will show, not only the more elementary concords, the fourth and the fifth and the one composed from them, the octave, but also all their forms and the concords put together from them. Those that are smaller than it do not contain <them all>, and those larger than it will not contain more, but only the same ones. Hence | the title 'complete' is given primarily to this kind of *systema*, which he has defined as that which contains all the concords together with the forms of each.

By the first definition, all the compound concords would be called *systemata*, though since the fourth and the fifth are more elementary, they would not properly be called *systemata*.⁷⁶¹ To the ancient writers, no doubt, | the octave seemed to be a self-sufficient *systema* (for the attunement had not yet been extended as far as the more complete *systema*, so as to construct the double octave which is more clearly manifested in music when it has reached completion,⁷⁶² in the way in which it was constructed later); but the octave and a fourth and the octave and a fifth would be much more deserving of that name, and even more so is the double octave itself. For each of them is bounded | by concords, whereas the name 'concords' should be given to the fourth and the fifth, from which the octave and then the others in the same way are constituted; and these are indeed made up from several <concords>. For the octave and a fourth is put together from a fourth, a fifth and a fourth. But Ptolemy judges only the double octave to be a concord of concords and also complete, since | all the concords are

⁷⁶⁰ Cf. 161.2–3 with n. 750.

⁷⁶¹ Each of them is a concord, but not a 'compound' concord, i.e. one put together *from* concords (plural), as Ptolemy's definition specifies.

⁷⁶² Here I paraphrase; the literal sense is 'in complete (or "perfected") music', that is, in music that has completed its evolution and is now in its final and perfect form. It has as it were 'grown up' (one of the senses of the adjective *teleios* ('complete') is 'adult'). Porphyry seems to mean that the existence and importance of the double octave system became more apparent when music had progressed beyond its 'ancient' condition to the perfection which it attained later. This contrast between the older and the more recent may reflect the distinction drawn by Aristophanes, Plato and many later writers between the 'simple and noble' type of music characteristic of the times before about 450 BC and the complex, modulating music introduced in the later fifth century. If so Porphyry is probably chronologically right; the double octave seems to have come into use as the framework for musical theory in the fourth century. But it is very unusual for Greek writers of later periods to represent the latter kind of music as having achieved a kind of completion or perfection; almost always they follow Aristophanes, Plato and Aristoxenus and condemn it as aesthetically corrupt.

- (30) τὰ σύμφωνα πάντα μετὰ τῶν εἰδῶν αὐτῶν θεωρεῖται· καὶ ὅσ' ἂν ᾧσι τὰ ὑπὲρ αὐτὸ πάντα, τοῦτο περιέχει δυνάμει. τὸ γὰρ δις διὰ πασῶν καὶ διὰ τεσσάρων φέρε περιέχει καὶ μόνον τὸ δις διὰ πασῶν δυνάμει· τὸ γὰρ δις διὰ πασῶν ἐν ἑαυτῷ καὶ τὸ διὰ τεσσάρων ἔχει καὶ περὶ τῶν ἄλλων ὁμοίως. τὰ δ' ὑπὸ τὸ δις διὰ πασῶν ἐλλείπειεν ἂν πρὸς τὰ περι-
- (35) εχόμενα ὑπ' αὐτοῦ, καθ' ὥς καὶ προϊὼν δείξει· ὅθεν φησὶ συνάγεται, ὅτι οὐκ ἔστι τέλειον σύστημα τὸ διὰ πασῶν καὶ διὰ τεσσάρων, διότι εἰ καὶ
- (164) τὰς συμφωνίας πάσας ἔχει, ἄνευ μέντοι τοῦ δις διὰ πασῶν, ἀλλ' οὖν τὰ εἶδη πάντα τοῦ διὰ πασῶν οὐ περιέχει.

τὰ δὲ τοῦ διὰ πέντε ποτὲ μὲν,

ποτὲ δ' οὐ· ἀλλ' ὅταν μὲν οὕτως ἔχῃ θέσεως, ὥστε τὸν τόνον διαzeugνῶναι <τὰ συνημμένα δύο τετράχορδα τοῦ ἐνός, τὰ μὲν τέσσαρα εἶδη τοῦ [5] διὰ πέντε περιέχει, τῶν δὲ τοῦ διὰ πασῶν ἑπτὰ μόνον τέσσαρα πάλιν, τὰ ἄφ' ὁποτέρου τῶν ἄκρων.>

- (5) Ἐνταῦθα ὁ τόνος διαzeugνῶσι τὰ δύο συνημμένα ὀξύτερα τετράχορδα ἀπὸ τοῦ βαρυτέρου ἐνός, τοῦ ἑτέρου βαρυτέρου λείποντος, ἐν οἷς τρισὶ συμφώνοις περιέχονται τοῦ μὲν διὰ πασῶν εἶδη τέσσαρα τὰ ὕστερα μόνον, τοῦ δὲ διὰ πέντε καὶ τὰ τέσσαρα.
- (10) Ὀξύτερου ἐνός, ὅπου τὰ μὲν τοῦ διὰ πέντε πάντα εἶδη θεωροῦνται, τὰ δὲ τοῦ διὰ πασῶν τέσσαρα μόνον.

- Εἰ μὲν ὁ τόνος διαzeugνῶσι τὰ δύο τετράχορδα ἢ τὸ ἐν ἀπὸ τῶν δύο ἢ τὰ δύο ἀπὸ τοῦ ἐνός, ὁποτέρως ἂν γένηται, τὰ τέσσαρα εἶδη τοῦ διὰ πέντε θεωροῦνται—προομολογουμένου ὅτι καὶ τὰ τρία τοῦ διὰ τεσσάρων·
- (15) οὐδὲ γὰρ περὶ τούτων φροντίζει· οὐδὲ γὰρ ὀρίζεται τῷ διαzeugκτικῷ τὸ διὰ τεσσάρων, ὥσπερ τὸ διὰ πέντε καὶ τὸ διὰ πασῶν—μόνα δὲ τοῦ διὰ πασῶν τὰ τέσσαρα. πλὴν εἰ μὲν διαzeugνῶσιν ὁ τόνος τὰ δύο ὀξύτερα τοῦ ἐνός βαρυτέρου, ὥς ἐπὶ τῆς πρώτης καταγραφῆς, τὰ ὕστερα τέσσαρα

5 ὀξύτερα] ὀξύτονα p

in lemmate 51.3 τὰ δὲ τοῦ διὰ πέντε — 4 ποτὲ δ' οὐ] τὰ δὲ τέσσαρα τοῦ διὰ πέντε οὐ πάντοτε Ptol. 5 τὰ συνημμένα — 7 τῶν ἄκρων e Ptol. addidi

found in it, together with their forms. And it also contains, potentially, all those larger than itself. Thus, for example, it contains potentially the double octave and a fourth as well as the double octave by itself, for it contains the double octave and also the fourth, and the same goes for the rest. Those smaller than the double octave would fall short of those | that it contains, as he will show as he continues; and from this it follows, he says, that the octave and a fourth is not a complete *systema*,⁷⁶³ since even if it contains all the concords but without including the double octave, it will not contain all the forms of the octave.

[164D]

. . . and it will sometimes contain the forms of the fifth and sometimes not.⁷⁶⁴ But when it is so positioned that the tone disjoins <two conjoined tetrachords from one tetrachord, it will contain the four forms of the fifth, but only four of the seven forms of the octave, those starting from either of the extremes>.
Ptol. *Harm.* 51.3–7

| In the case where the tone disjoins the two higher, conjoined tetrachords from the one that is lower – the other lower tetrachord being omitted⁷⁶⁵ – in these three tetrachords there are contained only the last four forms of the octave, along with the four forms of the fifth. In the case where the tone disjoins the two conjoined tetrachords from the one | that is higher, all the forms of the fifth are found, but only four of the octave.

If the tone disjoins the two tetrachords from the one or the one from the two, no matter in which of the two ways it happens, the four forms of the fifth are found, but only four forms of the octave. (It is taken for granted that the three forms of the fourth are found too, | for Ptolemy does not even consider them, since the fourth is not defined by reference to the disjunctive tone, as are the fifth and the octave.) We must add that if the tone disjoins the two higher tetrachords from the one that is lower, as in the first diagram,⁷⁶⁶

⁷⁶³ For further discussion of the *systema* of an octave and a fourth see Ptol. *Harm.* II.6 with Porphy. 168.13–173.4 below.

⁷⁶⁴ This is the form in which Porphyry quotes the text; the MSS of Ptolemy read ‘and it will not always contain the four forms of the fifth’.

⁷⁶⁵ This ‘other’ tetrachord is the one which together with the second disjunctive tone would complete the double octave.

⁷⁶⁶ The diagrams mentioned here and in the next sentence are closely related to those shown at the end of Ptol. *Harm.* II.3 and in the next lemma, but Porphyry cannot be referring to them when he speaks of them as the first and second. Either the diagrams he saw in his copy of Ptolemy were different from those preserved in our MSS, or else he presented diagrams of his own here, which have not survived. The same holds of the two diagrams he mentions at 164.30 and 165.4 below. The diagrams printed here are my own reconstructions.

- (20) τὸ ΜΔ, τὸ ΛΓ, τὸ ΚΒ, τὸ ΘΑ· εἰ δὲ διαζευγνύει ὁ τόνος τὰ δύο βαρύτερα τοῦ ἐνὸς ὀξυτέρου, ὡς ἐπὶ τῆς δευτέρας καταγραφῆς, τὰ πρότερα τέσσαρα τὸ ΟΗ, τὸ ΞΖ, τὸ ΝΕ καὶ τὸ ΜΔ. τοῦτο γὰρ δηλοῖ τὸ ἄφ' ὁποτέρου τῶν ἄκρων· ἢ γὰρ ἀπὸ τοῦ Α ἄρχονται καὶ λείπει τὸ βαρύτερον τετράχορδον τὸ ΜΝΕΟ, ἢ ἀπὸ τοῦ Ο καὶ λείπει τὸ ὀξύτερον τὸ ΑΒΓΔ.

ὅταν δ' οὕτως ἔχη θέσεως, ὥστε τὸν τόνον ἐπὶ τὸ πέρας εἶναι, <καὶ τὰ τρία τετράχορδα συνημμένα, ἐν μόνον εἶδος περιέξει καὶ τοῦ διὰ πέντε καὶ τοῦ διὰ πασῶν, ἢ τὸ πρῶτον ἢ τὸ ἔσχατον ἀμφοτέρων, ὡς ἐξέσται σκοπεῖν ἀπὸ τῆς προκειμένης κατα- [10] γραφῆς ἐπισυνάπτουσιν αὐτῇ καθ' ἑκάτερον τῶν περάτων ἐν ὁμοίως

	διὰ δ'		διὰ δ'		διάζευξις		διὰ δ'		
	διὰ δ'		διὰ δ'		διὰ δ'				
διάζευξις									

ἔχον τετράχορδον. ἐπὶ δέ γε τοῦ δις διὰ πασῶν, ὅταν ἐπὶ τὰ αὐτὰ καὶ ὁμοίως ἔχοντα τὰ δύο διὰ πασῶν συνίσταται, κατὰ πᾶσαν ἡντινοῦν τῶν διαζεύξεων ἀρχὴν τὰ τε τοῦ διὰ πασῶν εἶδη πάντα καὶ ἔτι τὰ τε τοῦ διὰ πέντε καὶ τὰ τοῦ διὰ τεσσάρων εὐρήσομεν περιειλημμένα καὶ πλέον [15] οὐδὲν ἐν ταῖς τοῦ δις διὰ πασῶν ὑπερβολαῖς.>

- (26) Ὅταν δ' ἅμα ὥσι τὰ τρία τετράχορδα, ὁ τόνος δ' ἔξωθεν τούτων ἐπὶ τὸ πέρας τὸ ἔσχατον· οὕτω γὰρ συνάγεται τὸ διὰ πασῶν καὶ διὰ τεσσάρων· εἰ μὲν τὸ ὀξύτερον λείπει τετράχορδον τὸ ΑΒΓΔ, τὸ πρῶτον

Highest										Lowest
A	B	C	D	E	Z	H	F	K	L	M
	fourth			fourth		tone	fourth			

they are the last four, MD, LC, KB and FA;⁷⁶⁷ but if the tone disjoins the two lower tetrachords | from the one that is higher, as in the second diagram,

Highest										Lowest									
D	E	Z	H	F	K	L	M	N	X	O									
	fourth			tone	fourth			fourth											

they are the first four, OH, XZ, NE and MD. The *systema* shows this when taken from either of its ends; for either they begin from A and omit the lower tetrachord MNXO, or they begin from O and omit the higher tetrachord ABCD.

But when it is so positioned that the tone | is at the limit, and the three tetrachords are conjoined, <it will contain only one form of the fifth and one of the octave, either the first or the last of both of them. This can be seen from the diagram set out below, if one adds to it one similar tetrachord at one end or the other.

	fourth			fourth		tone	fourth			
	fourth			fourth			fourth		tone	

But in the double octave, when the two octaves are similar and are put together in the same direction, then in every case, corresponding to every position in which the first of the disjunctions is placed, we shall find that all the forms of the octave, of the fifth and of the fourth are contained; and we shall find no further form in the concords that exceed the double octave>. Ptol. *Harm.* 51.7–16

But when the three tetrachords are together and the tone is at the extreme boundary – for this is a way in which the octave and a fourth is put together – if the higher tetrachord ABCD is omitted, the first forms both

⁷⁶⁷ The forms of the octave are numbered in accordance with Ptolemy's procedure; in the first form the tone is at the top, in the second it is in second place from the top, and so on.

- (30) εἶδος θεωρεῖται τοῦ τε διὰ πασῶν καὶ τοῦ διὰ πέντε· τοῦ μὲν διὰ πασῶν τὸ ΗΟ, τοῦ δὲ διὰ πέντε τὸ ΗΜ, ὡς ἐπὶ τῆς πρώτης ἔχει καταγραφῆς.
- (165) εἰ δὲ κεῖται μὲν ἔσχατος ὁ ΗΘ τόνος, ἄρχονται δὲ τὰ δύο τετράχορδα ἀπὸ τοῦ Α, ἥτοι ΑΒΓΔ καὶ ΔΕΖΗ, τὸ δὲ ΚΛΜ συνάπτεται τῷ Α καὶ τὸ ΜΝΞ Ο λείπει· τὸ ἔσχατον θεωρεῖται τοῦ τε διὰ πέντε τὸ ΔΘ καὶ τοῦ διὰ πασῶν τὸ ἔσχατον τὸ ΘΑ, ὡς ἐπὶ τῆς δευτέρας ἔχει καταγραφῆς.

ε'

Πόθεν μὲν οὖν τὸ διὰ πασῶν καὶ διὰ τεσσάρων σύστημα παρέξεται τῷ δις διὰ πασῶν <ἐν τοῖς ἐξῆς ἡμῖν ὑπ' ὅσιν ἔσται. τοὺς δὲ τοῦ [20] τῷ ὄντι τελείου καὶ δις διὰ πασῶν φθόγγους—πεντεκαίδεκα συνισταμένους διὰ τὸ κοινὸν ἔνα γίνεσθαι τοῦ τε βαρυτέρου καὶ τοῦ ὀξύτερου διὰ [52] πασῶν καὶ μέσον πάντων—ποτὲ μὲν παρ' αὐτὴν τὴν θέσιν, τὸ ὀξύτερον ἀπλῶς ἢ βαρύτερον, ὀνομάζομεν μέσῃ μὲν τὸν εἰρημένον κοινὸν τῶν

4 τέλος τοῦ δ' κεφαλαίου· ἀρχὴ τοῦ ε' κεφαλαίου add. p 5 ἐξήγησις εἰς τὸ πόθεν μὲν οὖν ἡ διὰ πασῶν G

in lemmate 51.19 τὸ διὰ τεσσάρων καὶ διὰ πασῶν σύστημα p 20 ἐν τοῖς ἐξῆς — 52.9—10 παρανήτην ὑπερβολαίων e Ptol. addidi

of the octave and of the fifth will be found, HO | in the case of the octave and HM in that of the fifth, as is shown in the first diagram.⁷⁶⁸

Highest								Lowest			
H	F	K	L	M	N	X	O				
							D	E	Z	(H)	
tone		fourth			fourth			fourth			

But if the tone HF lies at the end, while the two tetrachords begin from A (that is, ABCD and DEZH), and if KLM is conjoined with A, and MNXO is omitted,⁷⁶⁹ the last form of the fifth, DF, and of the octave, FA, are found, as is shown in the second diagram. [165D]

Highest				Lowest							
(F)	K	L	M								
			A	B	C	D	E	Z	H	F	
	fourth			fourth			fourth		tone		

Chapter 5

Why, then, was the *systema* of an octave and a fourth linked with the double octave?⁷⁷⁰ <But to the notes of the genuinely complete *systema*, the double octave – which are fifteen in all, because one is common to the lower and the upper octaves, and is the middle note of them all – we give the following names, sometimes in respect to their actual position (*thesis*), that is, to their being higher or lower absolutely. The one common to the two octaves,

⁷⁶⁸ On the diagrams see n. 766 above. A diagram coherent with its predecessors, such that it includes three conjoined tetrachords, omits the one treated as the highest, ABCD, and displays the first forms of the fifth and the octave, can be constructed only if the tone is at the top of the sequence, and if the lowest tetrachord is constructed in a way analogous to the one used for the highest tetrachord in the sentence that follows; cf. the next note.

⁷⁶⁹ The disjunctive tone HF is now at the bottom of the system, and MNXO is omitted. When Porphyry says that KLM is conjoined with A, he means that a tetrachord equivalent to FKLM is added above and in conjunction with the tetrachord ABCD, to complete the octave and a fourth. This manoeuvre corresponds to what Ptolemy has just called 'adding one similar tetrachord' at the upper end. If we take Porphyry's words at face value, the two ends of the system are in effect being joined together, so that the system becomes a circle, as in Ptolemy's representation of the double octave (see n. 753 above). But there is no warrant in Ptolemy for treating the *systema* of an octave and a fourth in this way.

⁷⁷⁰ Here again Porphyry's reading does not correspond exactly to the text in our MSS of Ptolemy, which reads: 'The reason why the *systema* of an octave and a fourth was linked with the double octave is an issue we shall consider later'; the reference is to *Harm.* II.6.

δύο διὰ πασῶν, προσλαμβανόμενον δὲ τὸν βαρύτατον καὶ νήτην ὑπερβολαίων τὸν ὀξύτατον, εἶτα τοὺς μὲν μετὰ τὸν προσλαμβανόμενον ἐπὶ τὸ ὀξύ μέχρι τῆς μέσης ὑπάτην ὑπάτων καὶ παρυπάτην ὑπάτων καὶ λιχα- [5] νὸν ὑπάτων καὶ ὑπάτην μέσων καὶ παρυπάτην μέσων καὶ λιχανὸν μέσων, τοὺς δὲ μετὰ τὴν μέσιν ὁμοίως μέχρι τῆς νήτης τῶν ὑπερβολαίων παραμέσιν καὶ τρίτην διεzeugμένων καὶ παρανήτην διεzeugμένων καὶ νήτην διεzeugμένων καὶ τρίτην ὑπερβολαίων καὶ παρανήτην ὑπερβολαίων . . . > [10]

- (8) Τὸ δις διὰ πασῶν τέλειόν ἐστι καὶ τὸν διαzeugτικὸν τόνον ἐν τῷ μέσῳ τῶν τεσσάρων τετραχόρδων ἔχον· φέρει τὸν αὐτὸν ὀξύτερον μὲν
(10) τῶν δύο βαρυτέρων τετραχόρδων, βαρύτερον δὲ τῶν δύο ὀξυτέρων τετραχόρδων. καὶ ὁ δὲ ὁ προσλαμβανόμενος ποιεῖ ἐν τοῖς δυσὶ βαρυτέροις τετραχόρδοις—παρέχει τόνον οὗτος, ἵνα συστή τὸ διὰ πασῶν μέχρι τῆς μέσης—τοῦτο καὶ αὐτὸς ὁ διαzeugτικὸς ἐπὶ τοῖς ἐτέροις δυσὶ τετραχόρδοις τοῖς ὀξυτέροις ποιεῖ, ἵνα συστή τὸ ὀξύτερον διὰ πασῶν ἀπὸ
(15) μέσης ἕως νήτης ὑπερβολαίων· καὶ ἔστι τοῦτο δις διὰ πασῶν διεzeugμένον σύστημα διὰ τὸν διαzeugτικὸν τόνον. παρέzeugται δὲ τούτῳ ἀπὸ μέσης τὸ τῶν συνημμένων τετράχορδον, καὶ ἔστιν ἡ μέση ὡς ὑπάτη τῶν συνημμένων, εἴτ' ἄλλη τις τρίτη τῶν συνημμένων, εἶτα παρανήτη τῶν συνημμένων, εἶτα νήτη τῶν συνημμένων· καὶ συνίσταται ἀπὸ μέσης τὸ
(20) τῶν συνημμένων τετράχορδον. εἴθ' ἡ παραμέση· ἐξῆς τὸ τῶν διεzeugμένων τετράχορδον καὶ εἶτα τὸ τῶν ὑπερβολαίων. ὅπως οὖν παρέzeugκεται τοῦτο, ἐξῆς ῥηθήσεται, νῦν δὲ περὶ τῆς ὀνομασίας τῶν φθόγων τοῦ δις διὰ πασῶν βούλεται λέγειν, ἄρχεται δ' ἀπὸ τῆς μέσης καὶ τὰ παρ' ἐκάτερα λέγει.

ποτέ δὲ παρὰ τὴν δύναμιν αὐτήν, τὸ πρὸς τι πῶς ἔχον, ὥς δὴ πρότε- [10]
ρον ἐφαρμόσαντες ταῖς θέσεσι <τάς κατὰ τὸ καλούμενον ἀμετάβολον
σύστημα δυνάμεις τοῦ δις διὰ πασῶν, ἵνα κοινὰς ἐπ' αὐτοῦ ποιησάμε-

9 φέρει] φέρε p 18 εἶτα — 19 συνημμένων^{sec.} om. G
in lemmate 52.11 τὰς κατὰ — 53.10 τὸν τρίτον c Ptol. addidi

mentioned just now, is called *mesē*; the lowest note is *proslambanomenos* and the highest is *nētē hyperbolaion*; then those after *proslambanomenos*, in the sequence upwards as far as *mesē*, are called *hypatē hypatōn*, *parhypatē hypatōn*, *lichanos hypatōn*, *hypatē mesōn*, *parhypatē mesōn* and *lichanos mesōn*; those after *mesē*, similarly, as far as *nētē hyperbolaion*, are called *paramesē*, *tritē diezeugmenōn*, *paranētē diezeugmenōn*, *nētē diezeugmenōn*, *tritē hyperbolaion* and *paranētē hyperbolaion* > ... Ptol. Harm. 51.19–52.10

The double octave *systema* is complete, and has the disjunctive tone in the middle of the four tetrachords; that is, it is higher than | the two lower tetrachords and lower than the two higher tetrachords. Indeed, what *proslambanomenos* does in the two lower tetrachords (it provides the tone which enables the octave as far as *mesē* to be constructed), the disjunctive tone does in the other two, higher tetrachords, enabling the higher octave from | *mesē* to *nētē hyperbolaion* to be constructed.⁷⁷¹ This is the 'disjoined' (*diezeugmenon*) double-octave *systema*, because of the disjunctive tone. But linked with it, starting from *mesē*, is the tetrachord *synēmmenōn*,⁷⁷² and *mesē* is as it were the *hypatē* of the tetrachord *synēmmenōn*. Then comes another *tritē*,⁷⁷³ *tritē synēmmenōn*, then *paranētē synēmmenōn*, then *nētē synēmmenōn*; and the tetrachord *synēmmenōn* | is constructed starting from *mesē*. Then comes *paramesē*,⁷⁷⁴ followed by the tetrachords *diezeugmenōn* and *hyperbolaion*. He will explain in the sequel how this one⁷⁷⁵ was linked on, but now he wants to talk about naming the notes of the double octave; he starts from *mesē*, and then speaks of what applies to those lying in each direction <from it>.

... | but sometimes we name them with respect to function (*dynamis*), that is, to the way in which they are related to something else. Here we first

⁷⁷¹ Each octave has a tone at the bottom (between *proslambanomenos* and *hypatē hypatōn*, and between *mesē* and *paramesē*), with two conjoined tetrachords above it. The roles of *proslambanomenos* and of the disjunctive tone above *mesē* are of course not as closely parallel as Porphyry's remarks suggest, since the former is a note while the latter is an interval. But this is just one case of several in which Porphyry, rather curiously, writes as if the word *proslambanomenos* was not the name of a note but that of the lower of the two disjunctive tones.

⁷⁷² The tetrachord 'of conjoined notes', that is, the tetrachord conjoined at *mesē* with the one below it. It provides an alternative to the tetrachord *diezeugmenōn*, 'of disjoined notes', as one proceeds upwards from *mesē*; in most representations of it, there is no further continuation upwards from its highest note. A scale beginning from *proslambanomenos* and following this route will therefore span the interval that has been under examination in the preceding passage, the octave and a fourth. For Ptolemy's interpretation of a *systema* that follows this route see Harm. II.6.

⁷⁷³ 'Another', because there are notes called *tritē* also in the tetrachords *diezeugmenōn* and *hyperbolaion*.

⁷⁷⁴ Porphyry has now returned to the fundamental two-octave sequence, in which *paramesē* is the upper boundary of the disjunctive tone whose lower boundary is *mesē*. *Paramesē* does not appear in the tetrachord *synēmmenōn*.

⁷⁷⁵ I.e. the tetrachord *synēmmenōn*.

νοι τὰς κατηγορίας τῶν τε θέσεων καὶ τῶν δυνάμεων μεταλαμβάνωμεν αὐτάς ἐπὶ τῶν ἄλλων. τὸν γὰρ ἕτερον τῶν ἐν τῷ δις διὰ πασῶν δύο τόνων ἀπὸ τῆς τῇ θέσει μέσης ἐκλαβόντες καὶ παραθέντες αὐτῷ καθ' [15] ἑκάτερον μέρος δύο τετράχορδα συνημμένα τῶν ἐν τῷ ὅλῳ τεσσάρων, εἶτα τὸν ἕτερον τόνον τῷ λοιπῷ καὶ βαρυτάτῳ τῶν διαστημάτων ἀποδόντες, μέσῃ μὲν τῇ δυνάμει καλοῦμεν ἀπὸ τῆς τότε καταστάσεως τὸν βαρύτερον τῆς ὀξυτέρας διαζεύξεως, καὶ παραμέσῃ τὸν ὀξύτερον, προσλαμβάνομενον δὲ καὶ νήτην ὑπερβολαίων τὸν βαρύτερον τῆς βαρυτέρας [20] διαζεύξεως, καὶ ὑπάτην ὑπάτων τὸν ὀξύτερον· εἶτα μέσων μὲν ὑπάτην τὸν κοινὸν τῶν συνημμένων δύο βαρυτέρων τετραχόρδων μετὰ τὴν βαρυτέραν διάζευξιν, νήτην δὲ διεzeugμένων τὸν κοινὸν τῶν συνημμένων [53] δύο <ὀξυτέρων> τετραχόρδων μετὰ τὴν ὀξυτέραν διάζευξιν, καὶ πάλιν παρυπάτην μὲν ὑπάτων τὸν ἀπὸ τοῦ βαρυτάτου δεύτερον τοῦ μετὰ τὴν βαρυτέραν διάζευξιν τετραχόρδου, καὶ λιχανὸν ὑπάτων τὸν τρίτον, παρυπάτην δὲ μέσων τὸν ἀπὸ τοῦ βαρυτάτου δεύτερον τοῦ πρὸ τῆς ὀξυτέρας διαζεύξεως τετραχόρδου, καὶ λιχανὸν μέσων τὸν τρίτον· εἶτα [5] τρίτην μὲν διεzeugμένων τὸν ἀπὸ τοῦ βαρυτάτου δεύτερον τοῦ μετὰ τὴν ὀξυτέραν διάζευξιν τετραχόρδου, καὶ παρανήτην διεzeugμένων τὸν τρίτον, τρίτην δὲ ὑπερβολαίων τὸν ἀπὸ τοῦ βαρυτάτου δεύτερον τοῦ πρὸ τῆς βαρυτέρας διαζεύξεως τετραχόρδου, καὶ παρανήτην ὑπερβολαίων τὸν τρίτον.> [10]

- (27) Ποτὲ μὲν κατὰ τὴν θέσιν αὐτὴν καὶ μόνην τὴν μέσῃ καλεῖ μέσῃ τῶν δύο διὰ πασῶν τοῦ ἐν τῷ δις διὰ πασῶν συστήματος. ἡ αὕτη γὰρ τοῦ
- (166) μὲν ἐνὸς διὰ πασῶν τοῦ βαρυτέρου ὀξυτέρα, θατέρου δὲ τοῦ ὀξυτέρου βαρυτέρα. ἀπὸ γὰρ τοῦ προσλαμβανομένου ἕως ταύτης τὸ βαρυτάτον διὰ πασῶν καὶ ἀπὸ ταύτης ἕως τῆς νήτης τῶν ὑπερβολαίων νητῶν τὸ ὀξύτατον διὰ πασῶν. μέσῃ γοῦν αὕτη κατὰ τὴν θέσιν τῶν δύο. ἐπι-
- (5) φέρει δὲ καὶ πῶς μέσῃ κατὰ τὴν δύναμιν. δύναται γὰρ αὕτη μέσῃ καλεῖσθαι συγκρινομένη πρὸς τὰς λοιπὰς τὰς παρ' ἑκάτερα καὶ οὐ μόνον καθ' αὐτὴν κατὰ τὴν θέσιν. ἐπειδὴ γὰρ δύο διαzeugτικοὶ τόνοι εἰσίν, ὁ μὲν τῆς βαρυτέρας διαζεύξεως, ὅς ἐστιν ἀπὸ τοῦ προσλαμβανομένου, ὁ δὲ τῆς ὀξυτέρας, ὅς ἐστιν ἀρχὴ τοῦ ὀξυτέρου διὰ πασῶν, ὡς ἐκεῖνος τοῦ
- (10) βαρυτέρου διὰ πασῶν, ἐκλαμβάνομεν τὸν ἕτερον τούτων τῶν δύο τόνων τὸν ὀξύτερον, ὅς γίνεται ἀπὸ τῆς τῇ θέσει μέσης, καὶ παρατίθεμεν τῷ τοιούτῳ τόνῳ καθ' ἑκάτερον μέρος δύο τετράχορδα· τὰ μὲν δύο ἐν τῷ βαρυτέρῳ τόπῳ, τὰ δὲ δύο ἐν τῷ ὀξυτέρῳ· δύο συνημμένα καὶ δύο συνημμένα· ἐν τῷ ὅλῳ γὰρ δις διὰ πασῶν τέσσαρά εἰσι τὰ τετράχορδα·

adjust to their positions <the functions that they have in what is called the 'changeless' (*ametabolon*) *systema* of the double octave, so that in this case we may use the same names for both the positions and the functions, and then alter them in the other cases. That is, we take one of the two tones in the double octave, from an origin at what is *mesē* by position, and out of the tetrachords that there are in the whole we place next to it on either side two tetrachords in conjunction, and then assign the other tone to the remaining interval, the lowest. We then give the name '*mesē* by function', from its positioning here, to the lower note of the higher disjunction, and the name '*paramesē*' to the higher note, '*proslambanomenos*' and '*nētē hyperbolaion*' to the lower note of the lower disjunction, and '*hypatē hypatōn*' to the higher note. Then we give the name '*hypatē mesōn*' to the note common to the two lower conjoined tetrachords after the lower disjunction, and '*nētē diezeugmenōn*' to the note common to the two higher conjoined tetrachords after the higher disjunction; and again '*parhypatē hypatōn*' to the second from lowest note of the tetrachord after the lower disjunction, '*lichanos hypatōn*' to the third; '*parhypatē mesōn*' to the second from lowest note of the tetrachord before the higher disjunction, and '*lichanos mesōn*' to the third; then '*tritē diezeugmenōn*' to the second from lowest note of the tetrachord after the higher disjunction, and '*paranētē diezeugmenōn*' to the third; '*tritē hyperbolaion*' to the second from lowest note of the tetrachord before the lower disjunction, and '*paranētē hyperbolaion*' to the third>. Ptol. *Harm.* 52.10–53.10

Sometimes Ptolemy gives the name *mesē* to the middle (*mesē*) note⁷⁷⁶ between the two octaves of the two-octave *systema*, on the basis of its position (*thesis*) alone; for it is the highest note of one octave, the lower, and the lowest of the other one, the higher. For the lowest octave extends to it from *proslambanomenos*, and the highest octave extends from it to *nētē hyperbolaion*. Thus on account of its position it is the *mesē* of the two. He names it | also, in a certain sense, as *mesē* by function (*dynamis*); for the same note can (*dynatai*) be called *mesē* when it is judged by its relation to the others on either side of it, and not just on its own on the basis of its position. For since there are two disjunctive tones, one being that of the lower disjunction, which starts from *proslambanomenos*, the other that of the higher disjunction, which is the beginning of the higher octave just as the former is the beginning of | the lower octave, we take the second, higher one of these two tones, which starts from *mesē* by position, and we place two tetrachords on either side of this tone, two in the higher region and two in the lower – two conjoined pairs.⁷⁷⁷ For in the double octave

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⁷⁷⁶ *Mesē* is the feminine form of the adjective *mesos*, 'middle', implicitly in agreement with the noun *chordē*, which means 'string' or 'note'.

⁷⁷⁷ Literally, 'two conjoined and two conjoined'.

- (15) τὸν δ' ἕτερον τῆς διαζεύξεως τόνον βαρύτατον ἀποδόντες μέσῃ μὲν τῇ
δυναμείᾳ καλοῦμεν τὴν καὶ τῇ θέσει μέσῃ συγκρίνοντες αὐτὸν τῇ ὀξυτέρᾳ
διαζεύξει, ἥς πρώτη αὕτη ἐστὶ καὶ διὰ ταῦτα βαρυτάτη, παραμέσῃ δὲ
τὸν ὀξύτερον πρὸς αὐτὴν δηλονότι τὸν ἐφεξῆς αὐτοῦ· τὴν δὲ βαρυτέραν
(20) ἐκείνην διάζευξιν ἰδόντες τὸν βαρύτερον πάσης ταύτης προσλαμβανό-
μενον καλοῦμεν, ὑπάτην δ' ὑπάτων τὸν τούτου ὀξύτερον καὶ αὐτοῦ ἐφε-
ξῆς· εἴτα μέσων ὑπάτην τὴν κοινὴν τῶν συνημμένων δύο βαρυτέρων
τετραχόρδων, ἣτις κεῖται μετὰ τὴν βαρυτέραν ἐκείνην διάζευξιν· νῆτην
δ' αὖθις διεzeugμένων τὸν κοινὸν τῶν συνημμένων δύο τετραχόρδων τῶν
(25) ὀξυτέρων πρὸς ἐκεῖνα τὰ δύο βαρύτερα· μετὰ τὴν ὀξυτέραν δὲ φησι
διάζευξιν, ὥσπερ μετὰ τὴν βαρυτέραν ἐκεῖ, ὅτι ἐν τοῖς τετραχόρδοις τού-
τοις οὐθ' ἡ βαρυτέρα ἐν ἐκείνοις παραλαμβάνεται· ἔξωθεν γὰρ κεῖται·
καὶ τὸ διὰ πέντε ἀναπληροῖ ἐν τῷ βαρυτάτῳ τετραχόρδῳ, ἵνα συστήῃ τὸ
βαρύτερον διὰ πασῶν· οὐθ' ὥδε ἡ ὀξυτέρα διάζευξις ἐν τούτοις τοῖς ὀξυ-
(30) τέροις δυσὶ τετραχόρδοις παραλαμβάνεται· ἔξωθεν γὰρ κεῖται καὶ αὕτη
καὶ τὸ διὰ πέντε συμπληροῖ ἐν τῷ πρώτῳ τετραχόρδῳ τοῦ ὀξυτέρου διὰ
πασῶν· καὶ αὖθις παρυπάτην μὲν ὑπάτων τὸν μετὰ τὴν ὑπάτην τῶν
ὑπάτων· ταύτην γὰρ καὶ βαρυτάτην λέγει μετὰ τὴν βαρυτάτην διάζευ-
ξιν, ἣτις ἐστὶν ὁ προσλαμβανόμενος· καὶ λιχανὸς ὑπάτων τὸν ἐφεξῆς
(35) τούτου καὶ τρίτον τοῦ μετὰ τὴν βαρυτάτην διάζευξιν βαρυτέρου τετρα-
χόρδου. ἐπεὶ δὲ τὴν ὑπάτην τῶν μέσων εἶπε, καθ' ἣν καὶ ἡ βαρυτέρα
συναφὴ ἐστὶ τῶν δύο βαρυτέρων τετραχόρδων, νῦν ὀνομάζει καὶ τὴν μετ'
(167) αὐτὴν παρυπάτην μέσων τὸν δεύτερον τοῦ δευτέρου τετραχόρδου, ὅπερ
πρὸ τῆς ὀξυτέρας διαζεύξεως λέγει, οὕτινος τετραχόρδου ὁ βαρύτατος ἡ
ὑπάτη τῶν μέσων ἦν. πληρὴ σημειῶσαι ὅτι, ὅτε μέλλει δηλῶσαι τὸ
σύνεγγυς τῆς διαζεύξεως τετράχορδον τῇ μετὰ προθέσει χρήται· μετὰ
(5) τὴν βαρυτέραν διάζευξιν τὸ πρῶτον τετράχορδον· ὅτε δὲ τὸ ἐφεξῆς τοῦ
προτέρου τετράχορδον θέλει δηλῶσαι, τῇ πρὸ προθέσει χρήται, τὸ διε-
χὲς δηλῶν ἐντεῦθεν καὶ διατεταμένον. πρὸ τῆς ὀξυτέρας τοῖνον διαζεύ-

19 ταύτης om. G

2 ὀξυτέρας e Ptol. βαρυτάτης codd.

7 ὀξυτέρας e Ptol. βαρυτάτης codd.

as a whole the number of tetrachords is four. | Setting aside the other tone of disjunction, the lowest, we give the name '*mesē* by function' to the note that is also *mesē* by position, locating it in the higher disjunction, of which it is the first and hence the lowest note; and we give the name *paramesē* to the note that is higher than it, that is, the one that comes next. When considering the lower disjunction, we call the note lower than the whole of it *proslambanomenos*, | and the one that is higher and comes next *hypatē hypatōn*. Then we give the name *hypatē mesōn* to the note which comes after this lower disjunction and is common to the two lower conjoined tetrachords, and again the name *nētē diezeugmenōn* to the note common to the two conjoined tetrachords which are higher in relation to those two lower ones. Ptolemy says 'after the higher | disjunction', like 'after the lower disjunction' in the other case, because neither is the lower disjunction included in these tetrachords – for it lies outside them, and with the lower tetrachord it completes the fifth, so that the lower octave can be constructed – nor is the higher disjunction included in the two higher tetrachords – for it too lies outside them, | and with the first tetrachord of the higher octave it completes the fifth. Again, we give the name *parhypatē hypatōn* to the note after *hypatē hypatōn*; for it is this that he calls the 'lowest' after the lowest disjunction, which is *proslambanomenos*,⁷⁷⁸ and we give the name *lichanos hypatōn* to the one next to it, the third note of the lower tetrachord which comes after the lowest disjunction. | And since he gives the name *hypatē mesōn* to the note where there is the lower conjunction, the one between the two lower tetrachords, he now calls the one after it *parhypatē mesōn* – it being the second note of the second tetrachord, which he describes as the one 'before the higher disjunction', whose lowest note is *hypatē mesōn*. But we must explain that when he is going to identify the tetrachord next to the disjunction, he uses the preposition 'after'; after | the lower disjunction comes the first tetrachord; whereas when he wants to identify the tetrachord next to the first one, he uses the preposition 'before', so indicating something discontinuous and stretched out.⁷⁷⁹ Thus he describes the second tetrachord as the one

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⁷⁷⁸ Cf. n. 771 above.

⁷⁷⁹ In the statement beginning 'whereas', Porphyry is referring to the fact that Ptolemy sometimes refers to the tetrachord below a disjunction as the one 'before' it, rather than as the one 'after' the tetrachord below it. His remark that Ptolemy's usage indicates 'something discontinuous and stretched out' does not refer, I think, only to what he has said about 'before', but to Ptolemy's use of the 'before and after' terminology as a whole. That it suggests something 'stretched out' is obvious enough; its extent is 'discontinuous' in the sense that it is divided into distinct sections, the tetrachords and disjunctions, following one another in sequence and marked off from one another by the notes. The conception of a linear dimension divided into intervals with boundaries demarcated by notes would be more at home in an Aristoxenian text, but Porphyry cannot be blamed for that; Ptolemy's language points clearly in the same direction.

- ξεως λέγει τὸ δεύτερον τετράχορδον, οὔτινος ἡ μὲν ὑπάτη τῶν μέσων βαρυτέρα, ἡ δὲ παρυπάτη τῶν μέσων καὶ μετ' αὐτὴν δευτέρα μετὰ τὴν βαρυτάτην τοῦ τετραχορδου· ὁμοίως καὶ λιχανὸν μέσων τὸν τρίτον τῶν μέσων, ὡς λιχανὸν ὑπάτων τὸν τρίτον τῶν ὑπάτων· εἴτ' αὖθις ἐπεὶ τὴν παραμέσσην βαρυτέραν ἔλεγε τοῦ τρίτου τετραχορδου, τὴν μετ' αὐτὴν τρίτην διεzeugμένων λέγει, ἥτις ἐστὶν ἀπὸ τῆς βαρυτάτης παραμέσσης δευτέρα τοῦ μετ' αὐτὴν [δὲ] τὴν ὀξυτέραν διάzeugειν τετραχορδου· καὶ τὸν τρίτον παρανήτην διεzeugμένων, ὡς πλησιάζοντα αὐτῇ τῇ νήτῃ διεzeugμένων, καθ' ἣν ἡ ὀξυτέρα ἐστὶ συναφὴ τῶν δύο τετραχορδων.
- Ἐπεὶ δ' ἐγκαταλείπεται μόνον τὸ ὕστερον τετράχορδον, οὗ ἡ βαρυτάτη ἡ νήτη τῶν διεzeugμένων ἦν, τὴν μετ' αὐτὴν καὶ τρίτην τῶν ὑπερβολαίων δευτέραν λέγει ἀπὸ τοῦ βαρυτάτου τοῦ πρὸ τῆς βαρυτέρας διαzeugεως τετραχορδου καὶ τὸν μετ' αὐτὴν, ὃς καὶ τρίτος ἐστὶ τοῦ τετραχορδου, παρανήτην ὑπερβολαίων [νητῶν] καλεῖ, ὡς πλησιάζοντα τῇ νήτῃ.

καὶ δὴ κατὰ ταύτας τὰς ὀνομασίας, τουτέστι τὰς τῶν [10] δυνάμεων, μόνως ἂν καλοῖντο κυρίως τῶν φθόγγων ἐστῶτες μὲν ἐν ταῖς τῶν γενῶν μεταβολαῖς προσλαμβανόμενος καὶ ὑπάτη ὑπάτων καὶ ὑπάτη μέσων καὶ μέση καὶ παραμέση καὶ νήτη διεzeugμένων καὶ νήτη ὑπερβολαίων, μία τις οὖσα καὶ ἡ αὐτὴ τῷ προσλαμβανόμενῳ, κινούμενοι δὲ οἱ λοιποί. μεταβιβαζομένων γὰρ τῇ θέσει τῶν δυνάμεων οὐκέτι [15] τοῖς αὐτοῖς τόποις ἐφαρμόζουσιν οἱ τῶν ἐστῶτων ἢ κινουμένων ὅροι. δῆλον δ' ὅτι καὶ τὸ μὲν πρῶτον εἶδος τοῦ διὰ πασῶν ἐν τῷ προκειμένῳ συστήματι, καλουμένῳ δ' ἁμεταβόλῳ, διὰ τὴν εἰρημένην αἰτίαν περιέχουσιν ἢ τε παραμέση καὶ ἡ ὑπάτη τῶν ὑπάτων, τὸ δὲ δεύτερον ἢ τε τρίτη τῶν διεzeugμένων καὶ ἡ παρυπάτη τῶν ὑπάτων, τὸ δὲ τρίτον ἢ [20] τε παρανήτη τῶν διεzeugμένων καὶ ἡ λιχανὸς τῶν ὑπάτων, τὸ δὲ τέταρτον ἢ τε νήτη τῶν διεzeugμένων καὶ ἡ ὑπάτη τῶν μέσων, τὸ δὲ πέμπτον ἢ τε τρίτη τῶν ὑπερβολαίων καὶ ἡ παρυπάτη τῶν μέσων, τὸ δὲ ἕκτον ἢ τε παρανήτη τῶν ὑπερβολαίων καὶ ἡ λιχανὸς τῶν μέσων, τὸ δὲ ἕβδομον ἢ τε νήτη τῶν ὑπερβολαίων ἢ ὁ προσλαμβανόμενος καὶ ἡ [25] μέση· ὡς ἔχουσι τοῦ προχείρου τῆς ἐπιβολῆς ἕνεκεν αἱ ὑποκείμεναι τοῦ ἁμεταβόλου συστήματος παρασημειώσεις.

11 ὑπάτων^{scd}] λιχανῶν G 14 [δὲ] del. Alexanderson 19 βαρυτέρας c Ptol. ὀξυτέρας codd.
21 [νητῶν] seclusi: secludendum coni. Düring

in lemmate 53.10 ὀνομασίας] σημασίας p 27 tabellam, quam exhibent hic codd. Ptolemaei, cum tabella sequentis lemmatis coniunxit Düring

‘before the higher disjunction’, of which the lowest note is *hypatē mesōn*, and he describes the note after it, *parhypatē mesōn*, as ‘the second note after the | lowest note of the tetrachord’.⁷⁸⁰ In the same way he gives the name *lichanos mesōn* to the third note of <the tetrachord> *mesōn*, and likewise *lichanos hypatōn* to the third note of <the tetrachord> *hypatōn*. Then again, since he has said that *paramesē* is the lowest note of the third tetrachord,⁷⁸¹ he calls the note after it *tritē diezeugmenōn*, which, beginning from the lowest note, *paramesē*, is the second note of the tetrachord after the higher disjunction. And | he calls the third note *paranētē diezeugmenōn*, since it is next-door to *nētē diezeugmenōn*,⁷⁸² where there is the higher conjunction of two tetrachords.

Since all that has been left out is the last tetrachord, whose lowest note was *nētē diezeugmenōn*, he says that the note after it, *tritē hyperbolaion*, is the second from the lowest note of the tetrachord before the lower | disjunction,⁷⁸³ and the one after it, which is the third in the tetrachord, he calls *paranētē hyperbolaion*, since it is next-door to *nētē*.

Then it is only on the basis of these names, that is, the names of the functions, that we can properly describe the following notes as ‘fixed’ in the modulations of the genera – *proslambanomenos*, *hypatē hypatōn*, *hypatē mesōn*, *mesē*, *paramesē*, *nētē diezeugmenōn* and *nētē hyperbolaion*, the last being one and the same as *proslambanomenos* – and the rest as ‘movable’. For when the functions are altered in position, the points belonging to the fixed or movable notes no longer correspond to the same places. And it is clear that the first form of the octave in the *systema* set out above, the one called ‘changeless’, is bounded for the reason given by *paramesē* and *hypatē hypatōn*, the second by *tritē diezeugmenōn* and *parhypatē hypatōn*, the third by *paranētē diezeugmenōn* and *lichanos hypatōn*, the fourth by *nētē diezeugmenōn* and *hypatē mesōn*, the fifth by *tritē hyperbolaion* and *parhypatē mesōn*, the sixth by *paranētē hyperbolaion* and *lichanos mesōn*, and the seventh by *nētē hyperbolaion* and *mesē*. For ease of reference, the designations forming the basis of the changeless *systema* are set out below. Ptol. Harm. 53.10–27⁷⁸⁴

⁷⁸⁰ Or perhaps ‘he describes’ does not govern this clause, in which case it would mean ‘and the note after it is *parhypatē mesōn*, the second note after the lowest note of the tetrachord’.

⁷⁸¹ The text has ‘lower’ where I translate ‘lowest’ (Porphyry is often a little careless in his choice of comparatives and superlatives), and might even be read as meaning ‘*paramesē* is lower than the third tetrachord’, which would clearly be misleading.

⁷⁸² The prefix *para-*, in this usage, means ‘alongside’.

⁷⁸³ In Ptolemy’s presentation of the double octave as a circular system (see n. 753 above), the ‘highest’ note (*nētē hyperbolaion*) is identical with the ‘lowest’ (*proslambanomenos*), as he says in the next lemma. *Proslambanomenos* is the lower boundary of the lower disjunction. Hence the tetrachord *hyperbolaion*, at the top of the system, is also the tetrachord before the lower disjunction.

⁷⁸⁴ Düring combines the diagram which appears here in the MSS with the one they show in the next lemma, and prints the combination after Ptol. 54.11. I have separated them and restored them to the positions they have in the MSS.

Σύστημα τέλειον
ἀμετάβολον διεζευγμένον

	<u>νήτη ὑπερβολαίων</u>
	<u>παρανήτη ὑπερβολαίων</u>
	<u>τρίτη ὑπερβολαίων</u>
	<u>νήτη διεζευγμένων</u>
	<u>παρανήτη διεζευγμένων</u>
	<u>τρίτη διεζευγμένων</u>
	<u>παραμέση</u>
	<u>μέση</u>
	<u>λιχανὸς μέσων</u>
	<u>παρυπάτη μέσων</u>
	<u>ὑπάτη μέσων</u>
	<u>λιχανὸς ὑπάτων</u>
	<u>παρυπάτη ὑπάτων</u>
	<u>ὑπάτη ὑπάτων</u>
	<u>προσλαμβανόμενος</u>

Figure 13G

The complete, changeless disjunct systēma

	<u>nētē hyperbolaiōn</u>
	<u>paranētē hyperbolaiōn</u>
	<u>tritē hyperbolaiōn</u>
	<u>nētē diezeugmenōn</u>
	<u>paranētē diezeugmenōn</u>
	<u>tritē diezeugmenōn</u>
	<u>paramesē</u>
	<u>mesē</u>
	<u>lichanos mesōn</u>
	<u>parhypatē mesōn</u>
	<u>hypatē mesōn</u>
	<u>lichanos hypatōn</u>
	<u>parhypatē hypatōn</u>
	<u>hypatē hypatōn</u>
	<u>proslambanomenos</u>

Figure 13

- (24) Ἐν τούτῳ τῷ ἀμεταβόλῳ συστήματι τῷ δις διὰ πασῶν τῷ συγκει-
 (25) μένω ἐκ τεσσάρων τετραχόρδων καὶ δυεῖν διαζευκτικῶν τόνων, τοῦ τε
 βαρυτέρου καὶ τοῦ ὀξυτέρου, ἐστῶτες φθόγγοι εὐρηνται οἱ ἑπτὰ, ὁ προσ-
 λαμβανόμενος, ἡ ὑπάτη ὑπάτων, ἡ μέση, ἡ παρα-
 μέση, ἡ νήτη τῶν διεζευγμένων καὶ ἡ νήτη τῶν ὑπερβολαίων, μία τις
 οὐσά φησι τῷ προσλαμβανομένῳ, ὅτι αὕτη αἰεὶ ἀκίνητος μένει καὶ ἐστῶσα
 (30) ὥσπερ καὶ ὁ προσλαμβανόμενος. οἱ δὲ λοιποὶ μεταβιβαζομένων τῇ θέσει
 τῶν δυνάμεων οὐκέτι τοῖς αὐτοῖς τόποις τοῖς ἀρχῇθεν ἐφαρμόσουσιν.
 ἐντεῦθεν δὲ καὶ τὰ εἶδη τοῦ διὰ πασῶν συνίστησι. πρῶτον μὲν γάρ
 (168) ἐστί τὸ περιεχόμενον ἕκ τε τῆς παραμέσης καὶ τῆς ὑπάτης ὑπάτων,
 δεύτερον δὲ τὸ περιεχόμενον ἕκ τε τῆς τρίτης τῶν διεζευγμένων καὶ τῆς
 παρυπάτης τῶν ὑπάτων, τρίτον τὸ ἐκ τῆς παρανήτης τῶν διεζευγμένων
 καὶ τῆς λιχανοῦ τῶν ὑπάτων, τέταρτον τὸ ἐκ τῆς νήτης τῶν διεζευγμέ-
 (5) νων καὶ τῆς ὑπάτης τῶν μέσων, πέμπτον τὸ ἐκ τῆς τρίτης τῶν ὑπερβο-
 λαίων καὶ τῆς παρυπάτης τῶν μέσων, ἕκτον τὸ ἐκ τῆς παρανήτης τῶν
 ὑπερβολαίων καὶ τῆς λιχανοῦ τῶν μέσων, ἑβδομον τὸ ἐκ τῆς νήτης τῶν
 ὑπερβολαίων καὶ τῆς μέσης ἢ ἕκ τε τῆς μέσης καὶ τοῦ προσλαμβανομέ-
 νου. καὶ οὕτως οὐδεμία τῶν χορδῶν ἀφίεται, ἀλλὰ πᾶσαι συνεχονται.

ς'

Τοῦτο μὲν οὖν τὸ σύστημα λέγεται καὶ διεζευγμένον πρὸς ἀντιδια- [30]
 [54] στολήν τοῦ λαμβανομένου κατὰ τὸ συντιθέμενον μέγεθος ἐκ τοῦ διὰ πασῶν
 καὶ διὰ τεσσάρων, ὃ καλεῖται συνημμένον ἔνεκεν τοῦ συνημμένον ἔχειν
 ἀντὶ τῆς διαζεύξεως τῇ μέσῃ τετράχορδον ἕτερον ἐπὶ τὸ ὄξύ, προσαγο-
 ρεούμενον καὶ αὐτὸ συνημμένον ἀπὸ τοῦ συμβεβηκότος, ὥσπερ καὶ τὸ
 διεζευγμένον, ἐφ' οὗ πάλιν τρίτην μὲν συνημμένων τὸν μετὰ τὴν μέσῃ [5]
 φθόγγον, παρανήτην δὲ συνημμένων τὸν ἐξῆς καὶ τὸν ἡγούμενον τοῦ
 τετραχόρδου καὶ ἐστῶτα νήτην συνημμένων. ὅμοιος μὲντοι τὸ τοιοῦτο
 σύστημα παραπεποιῆσθαι τοῖς παλαιοῖς πρὸς ἕτερον εἶδος μεταβολῆς,

9 τέλος του ε' κεφ. ἀρχὴ τοῦ ζ' κεφ. add. p

10 κεφ. ζ' εἰς τὸ τοῦτο μὲν οὖν τὸ σύστημα G

In this changeless *systema* of the double octave, composed | of four tetrachords and two disjunctive tones, the lower and the higher, these seven are found to be fixed notes: *proslambanomenos*, *hypatē hypatōn*, *hypatē mesōn*, *mesē*, *paramesē*, *nētē diezeugmenōn* and *nētē hyperbolaion*, which is identical with *proslambanomenos*, since | like *proslambanomenos* it always remains motionless and fixed; whereas when the functions change in position the remainder will no longer correspond to the same places as they originally did.⁷⁸⁵ Next, he also establishes the forms of the octave.⁷⁸⁶ For the first is the one bounded by *paramesē* and *hypatē hypatōn*, the second is the one bounded by *tritē diezeugmenōn* and *parhypatē hypatōn*, the third is the one bounded by *paranētē diezeugmenōn* and *lichanos hypatōn*, the fourth is the one bounded by *nētē diezeugmenōn* | and *hypatē mesōn*, the fifth is the one bounded by *tritē hyperbolaion* and *parhypatē mesōn*, the sixth is the one bounded by *paranētē hyperbolaion* and *lichanos mesōn*, and the seventh is the one bounded by *nētē hyperbolaion* and *mesē* or by *mesē* and *proslambanomenos*. In this way none of the notes⁷⁸⁷ is omitted, but all are included.⁷⁸⁸

[168D]

Chapter 6

The *systema* considered above is also called 'disjunct' (*diezeugmenon*), to distinguish it from that which is constructed on the basis of the magnitude put together from the octave and a fourth, which is called 'conjunct' (*synēmmenon*) because, instead of the disjunction, it has another tetrachord in conjunction with *mesē* and above it. This tetrachord is called 'conjunct' too, on account of the attribute it has (the 'disjunct' tetrachord gets its name in the same way), and in it the note after *mesē* is called *tritē synēmmenōn*, the one next in succession *paranētē synēmmenōn*, and the leading note of the tetrachord, a fixed note, is called *nētē synēmmenōn*. It appears that this sort of *systema* was invented by the ancients to accommodate a different form

⁷⁸⁵ This patently fails to explain why Ptolemy treats *proslambanomenos* and *nētē hyperbolaion* as the same note; and when the other notes, as identified by their functions, change their positions in the series (as they do in modulations of *tonos*, 'key', or in what Ptolemy calls 'modulations of melody'), the note which in its function is *proslambanomenos* and *nētē hyperbolaion* is no exception. Cf. n. 753 above, and on these modulations see especially *Harm.* II.6–7. Ptolemy himself does not explain his conception very clearly, and Porphyry seems to have completely missed the point.

⁷⁸⁶ The sense may be: 'From these facts he establishes . . . ' ⁷⁸⁷ Or 'strings'; the noun is *chordē*.

⁷⁸⁸ Porphyry's discussion in this chapter is much more elaborate than any other surviving account of these matters. It may well strike readers as pedantic and unnecessarily long, and it has little independent value for us as evidence about the names, positions and functions of the notes, tetrachords and disjunctions. But aside from certain apparent confusions when faced with Ptolemy's notion of the system's circularity, it presents its material remarkably – one might almost say uncharacteristically – clearly and accurately. Perhaps it provided exactly the assistance that the readers for whom Porphyry intended it needed.

ὥσανεὶ μεταβολικόν τι παρ' ἐκείνο ἀμετάβολον. οὐδὲ γὰρ τῷ κατὰ γένος
μὴ μεταβάλλειν λέγεται τοιοῦτον, ὃ ποτέ γε κοινόν ἐστι πάντων τῶν [10]
γενῶν, ἀλλὰ τῷ κατὰ τὴν τοῦ τόνου δύναμιν.

Σύστημα συνημμένων

	<u>νήτη συνημμένων</u>
	<u>παρὰνήτη συνημμένων</u>
	<u>τρίτη συνημμένων</u>
	<u>μέση</u>
	<u>λιχανὸς μέσων</u>
	<u>παρυπάτη μέσων</u>
	<u>ὑπάτη μέσων</u>
	<u>λιχανὸς ὑπάτων</u>
	<u>παρυπάτη ὑπάτων</u>
	<u>ὑπάτη ὑπάτων</u>
	<u>προσλαμβανόμενος</u>

Figure 14G

of modulation, being treated as ‘modulating’ (*metabolikon*) by contrast with the other, which is ‘changeless’ (*ametabolon*). For the latter is not given this name from its not modulating with respect to genus, since it is common to all the genera, but from its not modulating with respect to the function of the *tonos*.

The conjunct systēma

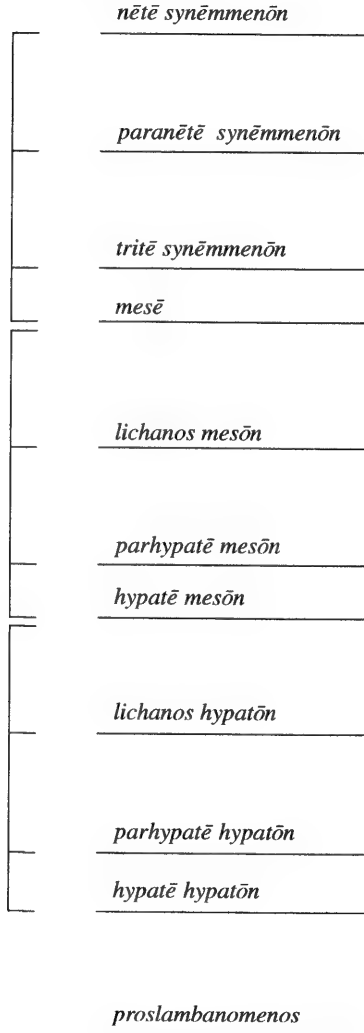


Figure 14

Εἰσὶ δὲ καὶ παρὰ τὸν οὕτω λεγόμενον τόνον μεταβολῶν δύο πρῶται διαφοραί, μία μὲν καθ' ἣν ὅλον τὸ μέλος ὁξύτερά τάσει διεξίμεν ἢ [55] πάλιν βαρυτέρα, τηροῦντες τὸ διὰ παντός τοῦ εἶδους ἀκόλουθον, δευτέρα

δὲ καθ' ἣν οὐχ ὅλον τὸ μέλος εξαλλάσσεται τῇ τάσει, μέρος δέ τι παρὰ τὴν ἐξαρχῆς ἀκολουθίαν. διὸ καὶ καλοῖτ' ἂν αὕτη τοῦ μέλους μᾶλλον ἢ τοῦ τόνου μεταβολή. κατ' ἐκείνην μὲν γὰρ οὐκ ἀλλάσσεται τὸ μέλος ἀλλ' ὁ δι' ὅλου τόνος, κατὰ ταύτην δὲ τὸ μὲν μέλος ἐκτρέπεται τῆς [5] οἰκείας τάξεως, ἢ δὲ τάσις οὐχ ὡς τάσις ἀλλ' ὡς ἔνεκα τοῦ μέλους, ὅθεν ἐκείνη μὲν οὐκ ἐμποιεῖ ταῖς αἰσθήσεσι φαντασίαν ἑτερότητας τῆς κατὰ τὴν δύναμιν, ὑφ' ἧς κινεῖται τὸ ἦθος, ἀλλὰ μόνης τῆς κατὰ τὸ ὁξύτερον ἢ βαρυτέρον. αὕτη δὲ ὥσπερ ἐκπίπτειν αὐτὴν ποιεῖ τοῦ συνήθους καὶ προσδοκωμένου μέλους, ὅταν ἐπὶ πλέον μὲν συνείρηται [10] τὸ ἀκόλουθον, μεταβαίνει δὲ πρὸς ἕτερον εἶδος ἤτοι κατὰ γένος ἢ κατὰ τὴν τάσιν, οἷον ὅταν ἀπὸ διατονικοῦ συνεχοῦς ἀποκλίνη πρὸς τὸ γένος ἐπὶ χρωματικόν, ἢ ὅταν ἀπὸ μέλους ἐπὶ τοὺς διὰ πέντε συμφώνους ἐιωθότως ποιῆσθαι τὰς μεταβάσεις ἐπὶ τοὺς διὰ τεσσάρων γένηται τις ἐκτροπή, καθάπερ ἐπὶ τῶν ἐκκειμένων συστημάτων. [15]

- Περὶ τοῦ συστήματος τοῦ συγκειμένου ἐκ δύο διὰ πασῶν ἐν πεντεκαϊδεκαχόρδῳ ὀργάνῳ λέγων φησίν, ὅτι τοῦτο λέγεται καὶ διεzeugμένον
- (15) ἐκ τοῦ συμβεβηκότος αὐτοῦ. ἔστι γὰρ μέσον τῶν δύο διὰ πασῶν τόνος διαzeugτικός, τὸν τοῦ προσλαμβανομένου τόπον ἀναπληρῶν εἰς τὸ συστή-
ναι τὸ δεύτερον διὰ πασῶν. πρὸς οὖν διαστολὴν τοῦ συνημμένου συστή-
ματος, ὅπερ σύγκειται ἐκ τοῦ διὰ πασῶν καὶ διὰ τεσσάρων, λέγεται
- (20) τοῦτο διεzeugμένον, καὶ ἀμετάβολον μὲν τὸ τοιοῦτον, ἐκεῖνο δὲ μεταβο-
λικόν. οὐ γὰρ τὴν διάzeugξιν ἔχει, ἀλλ' ὁμοῦ τὰ τρία τετράχορδα ἅμα
τῷ ἀρχῇθεν προσλαμβανομένῳ. μετὰ γὰρ τὴν μέσσην, ἥτις ἐστὶν ὡς νῆτη
τοῦ πρώτου διὰ πασῶν, συνηπται ἀπὸ ταύτης τὸ τρίτον τετράχορδον,
ὡς εἶναι τὴν μετ' αὐτὴν τρίτην συνημμένων καὶ τὴν ἐφεξῆς παρανήτην
συνημμένων καὶ τὴν μετ' αὐτὴν, ἣν λέγει καὶ ἡγούμενον καὶ ἐστῶτα,
- (25) νῆτην συνημμένων, ὡς εἶναι ἐφεξῆς τὰ τρία τετράχορδα δίχα τινὸς δια-
zeugεως. καὶ ἔστι τοῦτο παραπτεποιημένον τοῖς παλαιοῖς μεταβολικόν
τι πρὸς ἐκεῖνο ἀμετάβολον. οὐδὲ γὰρ ἐκεῖνο λέγεται ἀμετάβολον, ὡς μὴ
μεταβάλλον κατὰ τὰ τρία γένη τῆς μελωδίας, ὅπου γε καὶ κατὰ πάντα
μεταβάλλει, ἢ κατὰ δίεσιν, δίεσιν καὶ δίτονον, ὡς ἐν τῷ ἐναρμονίῳ, ἢ
- (30) κατὰ ἡμιτόνιον, τόνον καὶ τόνον, ὡς ἐν τῷ διατονικῷ, ἢ κατὰ ἡμιτόνιον,

In relation to what in this sense is called '*tonos*' there are two primary types of modulation, one in which we go through a whole melody at a higher pitch or a lower one, keeping the sequence the same throughout, and a second in which the whole of the melody is not altered in pitch, but a part is altered in contrast to the original sequence. Hence the latter should be called modulation of melody, rather than of *tonos*. For in the former it is not the melody but the *tonos* throughout the whole that is altered, while in the latter the melody is turned away from its proper ordering, while the pitch is not altered as such, but as having an effect on the melody. Hence the former kind does not implant in the perception the impression of a difference in respect of function, through which the melody's character is changed, but only of a difference in respect of height or depth of pitch. But the latter as it were expels the perception from the melody that is familiar and expected, when it has first strung together a coherent sequence of some length, and then changes in some way to a different form, either in respect of genus or in that of pitch – for instance when it modifies the genus from continuous diatonic to chromatic, or when, beginning from a melody that has habitually made its transitions to notes concordant at the fifth, there occurs a change of course to notes concordant at the fourth, as in the case of the *systemata* set out above. Ptol. *Harm.* 53.30–55.15

Speaking of the *systema* put together from two octaves on a fifteen-stringed instrument, he says that it is also called 'disjunct' | on account of its attribute. For in the middle of the two octaves there is a disjunctive tone, taking the place of *proslambanomenos*⁷⁸⁹ in the construction of the second octave. So to distinguish it from the conjunct *systema*, which is composed of an octave and a fourth, he calls this one 'disjunct', and he also calls it 'changeless' and the other 'modulating'. | For it [sc. the conjunct *systema*] does not have the disjunction, but has the three tetrachords together, along with *proslambanomenos* from which it begins. For after *mesē*, which is as it were the *nētē* of the first octave, the third tetrachord is conjoined with *mesē*, so that the note after it is *tritē synēmmenōn* and the next one *paranētē synēmmenōn*, and the next one, which he calls both 'leading' and 'fixed', | is *nētē synēmmenōn*, so that there are three tetrachords in sequence without any disjunction. And this was invented by the ancients as something modulating, by contrast with the other which is changeless. He does not call the latter 'changeless' because it does not modulate in respect of the three genera of melody, where indeed it modulates throughout, <proceeding> either by diesis, diesis and ditone as in the enharmonic, or | by half-tone, tone and tone as in the diatonic, or by half-tone, half-tone

⁷⁸⁹ Cf. n. 771 above.

ἡμιτόνιον καὶ τριημιτόνιον, ὡς ἐν τῷ χρωματικῷ· ταῦτα δὲ πάντα ἀπὸ

- (169) βαρέος ἐπὶ τὸ ὀξύ, ἐπὶ τὸ ἀνάπαλιν, ὅταν ἀπὸ ὀξέος ἐπὶ τὸ βαρὺ μελωδῇται. οὐ διὰ τοῦτο οὖν ἀμετάβολον τὸ ἀμετάβολον, ἀλλὰ διὰ τὴν τοῦ τόνου δύναμιν, δις διαζευγνύει τὰ δύο διὰ πασῶν, καὶ τέλειον σύστημα καθιστᾷ τὸ δις διὰ πασῶν· οὐ κατὰ δόξαν ὡς τὸ συγκείμενον ἐκ διὰ πασῶν καὶ διὰ τεσσάρων ἐν τῷ συντίθεσθαι ἅμα τὰ τρία τετράχορδα, ἀλλὰ κατ' ἀλήθειαν ἐν τῷ πάντα τὰ εἶδη τοῦ τε διὰ τεσσάρων, τοῦ τε διὰ πέντε, τοῦ τε διὰ πασῶν ἐμφαίνεσθαι ἐν τούτῳ. ἔστι μὲν οὖν καὶ λέγεται μεταβολικὸν καὶ αὐθις ἀμετάβολον ἐναντία, τοῦ τόνου τούτου τοῦ διαζευκτικοῦ ἢ παρόντος ἢ λείποντος. εἰσὶ δὲ καὶ κατ' ἄλλον τρόπον ἐν τούτοις δύο διαφοραὶ τῶν μεταβολῶν καὶ πρῶται, μία μὲν, καθ' ἣν τὸ τῆς μελωδίας ἦθος καὶ τὴν ἀπήχησιν τηροῦμεν, εἰς ὀξύτεραν δ' ἢ βαρυτέραν τάσιν μεταφέρομεν τὸ τοιοῦτον μέλος, δευτέρα δέ, καθ' ἣν συνάμα τῇ τάσει ἐξαλλάσσεται ἐκ μέρους καὶ τὸ μέλος· διὸ καὶ καλοῖτ' ἂν αὕτη τοῦ μέλους μεταβολή, ἐκείνη δὲ τοῦ τόνου· κατ' ἐκείνην μὲν (15) γὰρ οὐ τὸ μέλος, ἀλλ' ὁ τόνος ἀλλάσσεται, κατὰ ταύτην δ' ἐκτρέπεται τὸ μέλος. ἡ δὲ τάσις καὶ αὕτη ἂν πρὸς τὸ ὀξύτερον ἢ τὸ βαρύτερον ἐξ ἀνάγκης παρατραπείη, ἀλλ' οὐχ ὡς τάσις μόνον, ἀλλὰ χάριν τοῦ μέλους, ὅθεν ἐκείνη μὲν ὀξυνομένη μόνον ἢ βαρυνομένη κατὰ τόνον μόνον ἔχουσα τὴν μεταβολήν, οὐκ ἐμποιεῖ ταῖς αἰσθήσεσι φαντασίαν τῆς ἑτερότητας, (20) ἡ δ' ἑτέρα, ἥτις ἐστὶ κατὰ τὸ μέλος, ἐκβαίνει τοῦ συνήθους καὶ προσδοκωμένου, ὅταν ἐπέκεινα τοῦ διὰ πασῶν συνείρηται τὸ μέλος, μεταβαίνει δὲ πρὸς ἕτερον εἶδος διὰ τὸ λείπειν τὴν διάζευξιν ἢ κατὰ γένος,

8 ἐναντία] ἐν αἰτία G

9 εἰσι] ἔστι p

22 διὰ τὸ λείπειν τὴν διάζευξιν del. Alexanderson

and trihemitone as in the chromatic.⁷⁹⁰ (All these run from low to high, and they are reversed when they are played from high to low.) So it is not for this reason that the changeless *systema* is changeless, but because of the function of the tone which disjoins the two octaves,⁷⁹¹ and which produces the double octave, the complete *systema*, not <complete> on the basis of opinion, like the one composed from | an octave and a fourth, in that the three tetrachords are put together, but on that of truth, in that all the forms of the fourth, the fifth and the octave are displayed in it. Now 'modulating' and 'changeless' are opposites, and are said to be so, since this disjunctive tone is either present or absent.⁷⁹²

But in these *systemata*, in another way, | there are two primary different kinds of modulation. In one of them we maintain the character of the melody and the sound,⁷⁹³ while we shift such a melody to a higher or a lower pitch; and in the second, part of it is altered in pitch and the melody is altered simultaneously. Hence the latter would be called modulation of melody, and the former modulation of *tonos*; for in the former | not the melody but the *tonos* is changed, but in the latter the melody is turned away;⁷⁹⁴ the pitch itself would necessarily turn it aside upwards or downwards, not however simply as pitch, but for the sake of the melody. Hence the former, which being only made higher or lower has only the modulation of *tonos*, does not implant in the perception the impression of difference, | while the other, that is the modulation of melody, departs from what is familiar and expected, when the melody is drawn beyond the octave and shifts to a different form because the disjunction is absent, or <changes>

⁷⁹⁰ Here again Porphyry uses – presumably for convenience – the formulations most commonly found in Aristoxenian writers, rather than listing the complex sets of ratios that were worked out in Book I; and in the ratio-based formulations, of course, there is no such interval as an exact half-tone.

⁷⁹¹ Porphyry interprets Ptolemy's phrase 'the function of the *tonos*' in the preceding lemma (*Harm.* 54.11) as referring to the interval of a tone. This is linguistically possible, since *tonos* can mean both 'interval of a tone' and (approximately) 'key'. But it is unlikely to have been what Ptolemy meant, not least because in his next sentence the word's sense is unambiguously 'key'.

⁷⁹² Porphyry is apparently drawing on a point of logic to show that the attributes 'modulating' and 'changeless' are mutually exclusive. There can be no *systema* in which the disjunctive tone is both present and absent, and there is no middle way between them.

⁷⁹³ Here 'sound' is a weak translation of the Greek *apēchēsis*, more literally a 'resounding-out'. Perhaps Porphyry intends a hendiadys, giving a sense such as 'the sounding character of the melody', i.e. the character that is conveyed in the sound, but his word-order discourages this hypothesis.

⁷⁹⁴ I.e. turned aside from the course that would naturally be expected. Porphyry follows Ptolemy in thinking of a modulation of this sort as presupposing a 'natural', unmodulated form of the melody. The modulation disrupts it by continuing the same melody either in a different key or using intervals which correspond to those of the unmodulated version but have the sizes of corresponding intervals in another genus. Ptolemy construes a modulation between disjunct and conjunct systems as an instance of the former type, specifically as a modulation between *tonoi* a fourth apart; see the end of next lemma.

- (25) ὥσπερ ἂν ἀπὸ τοῦ διατονικοῦ εἰς τὸ χρωματικὸν φέρε, ἢ ὅταν ἀπὸ μέλους τοῦ τῶν διὰ πέντε, ὅπερ προσεδοκᾷ διὰ τὴν διάζευξιν, εἰς τοὺς διὰ τεσσάρων φθόγγους, ὅτε λείπει ἡ διάζευξις· μεταβάλλει γὰρ ἀπὸ τοῦ διεζευγμένου εἰς τὸ συνημμένον.

ἀναβαῖνον [15]

γὰρ τὸ μέλος ἐπὶ τὴν μέσην, ὅταν μὴ ὡς ἔθος εἶχεν ἐπὶ τὸ τῶν διεζευγμένων τετράχορδον ἔλθῃ κατὰ τὴν διὰ πέντε συμφωνίαν τῷ τῶν μέσων, <ἀλλὰ περισπασθὲν ὥσπερ συναιρεθῇ πρὸς τὸ συνημμένον τῇ μέσῃ τετράχορδον, ὥστε ἀντὶ τοῦ διὰ πέντε τὸ διὰ τεσσάρων ποιῆσαι πρὸς τοὺς πρὸ τῆς μέσης φθόγγους, ἐξαλλαγή γίνεται καὶ πλάνη ταῖς αἰσθήσεσι [20] τοῦ γενομένου παρὰ τὸ προσδοκηθὲν, καὶ πρόσφορος μὲν, ὅταν σύμμετρος ἢ συναίρεσις καὶ ἑμμελής, ἀπρόσφορος δέ, ὅταν τούναντίον. διὸ καλλίστη καὶ μία δυνάμει σχεδὸν ἐστὶν ἡ ὁμοία τῇ προειρημένην τονιαίαν λαμβάνουσα τὴν προληπτικὴν μετάπτωσιν, ἣ διαφέρει τὸ διὰ πέντε τοῦ διὰ τεσσάρων. τῷ μὲν γὰρ κοινὸς εἶναι τῶν γενῶν ὁ τόνος ἐν ἅπασιν [25] αὐτοῖς δύναται ποιεῖν τὴν μεταβολήν, τῷ δὲ τῶν ἐν τοῖς τετραχόρδοις λόγων ἕτερος ἐξαλλάσσειν τὸ μέλος, τῷ δὲ σύμμετρος ὡς ἂν πρῶτος συνιστάμενος τῶν ἑμμελῶν, μήτε μεγάλας τὰς ἐκβάσεις τοῦ μέλους, μήτε βραχείας πάνυ καθιστάναι· δυσδιάκριτον γὰρ ἐκάτερον τούτων [56] ταῖς ἀκοαῖς. γίνεται μὲν οὖν τρία τετράχορδα κατὰ τὸ ἐξῆς συνημμένα πρὸς τὸ τῆς τοιαύτης μεταβολῆς ἴδιον μίξει τινὶ μερικῇ δύο διεζευγμένων συστημάτων, ὅταν ὅλα διαφέρωσιν ἀλλήλων κατὰ τὸν τόνον τῷ διὰ τεσσάρων.>

- (30) Διδάσκει, πῶς γίνεται ἡ τοῦ μέλους ἐξαλλαγή ταῖς αἰσθήσεσι. προσδοκᾷ γὰρ ἡ αἴσθησις μετὰ τὸ τῶν μέσων τετράχορδον τοῦ μέσου φθόγου κρουσθέντος διάζευξιν τόνου καὶ εἶθ' οὕτω τετράχορδον ὡς τοὺς φθόγγους τοῦ διὰ πέντε φανῆναι· οὐ μὴν δ' οὕτω γίνεται, ἀλλὰ λαμβάνεται ἡ μέση αὕτη ὡς ἀρχὴ τοῦ συνημμένου ὀξυτέρου τετραχόρδου, καὶ ὁ ἐφεξῆς φθόγγος τρίτη συνημμένων λέγεται, εἴτα παρανήτη καὶ εἴτα ὁ ἡγούμενος τοῦ τοιοῦτου τετραχόρδου νήτη, ὡς γίνεσθαι τὸ πᾶν σύστημα φθόγγων ἰά· καὶ κατὰ τοῦτο περισπᾶται καὶ ἐξαλλαγή γίνεται (170) ταῖς αἰσθήσεσι. τοὺς δὲ πρὸ τῆς μέσης φθόγγους τοὺς ἀνωτέρω καὶ (5) ὀξυτέρους φησί· ὅταν γοῦν σύμμετρος καὶ ἑμμελής ἢ συναίρεσις γίνηται,

in respect of genus, as for example from the diatonic to the chromatic, or when <it shifts> from the melody of fifths, which was expected because of the disjunction, to the notes at | a fourth where the disjunction is absent; for it modulates from the disjunct *systema* to the conjunct.

For when the melody has risen to *mesē*, and then does not go on, as its habit has been, to the tetrachord *diezeugmenōn*, which is related in the concord of a fifth to the tetrachord *mesōn*, <but is pulled round, as it were, and linked to the tetrachord conjunct with *mesē*, so that it makes a fourth instead of a fifth with the notes before *mesē*, when this happens, contrary to expectation, then the senses are presented with a complete change and a deviation – an agreeable one when the linkage is well proportioned and melodic, disagreeable when it is the opposite. Hence just about the finest modulation, single in its function, is that which is like the one just mentioned in using for the transition the anticipated interval of a tone, that by which the fifth exceeds the fourth. For in that it is common to the genera, the tone can make this modulation in all of them; in that it is different from the ratios inside the tetrachords it can thoroughly alter the melody; and in that it is well proportioned, in accordance with its constitution as the first of the melodics, it makes the transitions of the melody neither very large nor altogether insignificant. For either of these is difficult for the ear to distinguish.

Now three successive conjunct tetrachords were produced, to create the special feature of this sort of modulation, by a kind of partial mixture of two disjunct *systemata*, when – taken as wholes – they differ from one another in *tonos* by a fourth.> Ptol. *Harm.* 55.15–56.4

| Ptolemy is explaining how the alteration of melody presents itself to perception.⁷⁹⁵ For when the middle note [sc. *mesē*] is played after the tetrachord *mesōn*, perception expects the disjunction of a tone and then a tetrachord, so that the notes at a fifth are presented;⁷⁹⁶ but it does not happen in this way; instead, *mesē* itself is taken as the starting-point of the higher tetrachord, *synēmmenōn*, the next note is called *tritē synēmmenōn*, then comes *paranētē*, and then the leading note of this tetrachord, *nētē*, so that the whole *systema* has eleven notes. In this way the melody is diverted and presents an alteration | to perception. (By ‘the notes before *mesē*’ he means those above it and higher than it.⁷⁹⁷) Then when the linkage is well

[170D]

⁷⁹⁵ Literally, ‘how the alteration of melody comes to be for the perceptions’. The following remarks suggest that he is referring to Ptolemy’s identification of the feature of our experience which tells us that an ‘alteration’ of the relevant sort has occurred.

⁷⁹⁶ That is, each of the notes in the higher tetrachord (*diezeugmenōn*) lies at the interval of a fifth above its counterpart in the lower tetrachord (*mesōn*) through which the melody has passed.

⁷⁹⁷ This is an error; Ptolemy is referring to those in the tetrachord below it (cf. 167.3–7). We might charitably suppose that the parenthesis has slipped into the text from an inept marginal note.

- πρόσφορός ἐστι ταῖς ἀκοαῖς, ὅταν δὲ τοῦναντίον, ἀπρόσφορος. ἐπεὶ τοίνυν ποτὲ μὲν πρόσφορός ἐστιν ἐξαλλασσομένη, ποτὲ δ' ἀπρόσφορος ἐν τῷ μὴ εἶναι τὸν διαζευκτικὸν τόνον, εἰς ἐξισασμὸν κάλλιστόν ἐστι τὸ
- (10) λαμβάνειν τὴν προσληπτικὴν μετάπτωσιν, ἥγουν τὸν τόνον τὸν κατὰ τὸν προσλαμβανόμενον, ᾧ δὴ καὶ διαφέρει τὸ διὰ πέντε τοῦ διὰ τεσσάρων κατὰ τὸν ἐπὶ ἢ λόγον, ὃς καὶ ὡς κοινὸς τῶν τριῶν γενῶν. δύναται γὰρ ἐντεῦθεν συσταθῆναι τὸ ἐξῆς τετράχορδον κατὰ μεταβολὴν γένους, ὡς συστήναι μετὰ διατονικὸν φέρε ἐναρμόνιον ἢ χρωματικόν· “ἐξαλλάσσει
- (15) τὸ μέλος” ἢ γὰρ διάζευξις ἢ κοινὴ ἀποτελευτᾷ μὲν καὶ τὸ πρότερον ὀλοτελῶς, δίδωσι δὲ καὶ τῷ δευτέρῳ ἐνάρχεσθαι κατὰ τὸ ἴδιον μέλος, ὡς δ' ἕτερος λόγος τῶν λόγων τῶν ἐκατέρωθεν τετραχόρδων—ἴδια γὰρ εἰσι τὰ τετράχορδα καὶ οἱ τούτων λόγοι πρὸς τὸν τοιοῦτον ἐπὶ ἢ—ἐξαλλάσσει προσφόρως τὸ μέλος καὶ οὐ συμβαίνει τὸ ἀπρόσφορον ἐν τῷ συ-
- (20) νάπτεσθαι τὰ τετράχορδα. γίνεται γὰρ τοῦ μὲν βαρυτέρου τετραχόρδου τέλος, τοῦ δ' ὀξυτέρου ἀρχὴ ὁ αὐτός. καὶ φέρε κατὰ τὴν διατονικὴν μελῳδῆσιν ἀπαιτεῖται ὁ αὐτὸς μέσος ὡς ὀξύτερος τοῦ βαρυτέρου τετραχόρδου τόνον ἔχειν, ὡς δὲ βαρύτερος τοῦ ὀξυτέρου τετραχόρδου ἡμι-

proportioned and melodic, it is agreeable to the hearing, and when it is the opposite it is disagreeable.

Now⁷⁹⁸ since it is sometimes agreeable when altered, and sometimes disagreeable in its omission of the disjunctive tone, the finest way of achieving equality is | to adopt the 'proseptic' transition,⁷⁹⁹ that is, through the tone that goes with *proslambanomenos*, by which the fifth exceeds the fourth in the ratio 9:8, and which is also common to the three genera. For on this basis the next tetrachord can be constituted with a modulation of genus, for instance constituting an enharmonic or chromatic tetrachord after one that is diatonic.⁸⁰⁰ 'It alters | the melody',⁸⁰¹ for the common disjunction is abolished, as is the whole of what has gone before, and it allows the second tetrachord to set off in accordance with its own kind of melody; and since it is a different ratio from those on either side of it⁸⁰² – for the tetrachords have their own specific characteristics, as do their ratios by comparison with this 9:8 ratio – it alters the melody agreeably, and nothing disagreeable arises in the | conjoining of the tetrachords, since the end of the lower tetrachord and the beginning of the higher become the same note. Thus in the diatonic genus, for instance, the same middle note is required both to be at the interval of a tone in its role as the highest note of the lower tetrachord, and to be at the interval of a half-tone in its role as the lowest

⁷⁹⁸ In his note ad loc. Alexanderson interprets 170.12–26 as an expanded paraphrase of Ptol. *Harm.* 55.25–9, and he is clearly right. He also asserts that that passage, and by implication the whole of 107.7–27, is to be taken as a single sentence with several long parentheses. But this reading, I think, distorts some of the connections in Porphyry's (admittedly tangled) line of thought, and I have preferred a punctuation closer to Düring's.

⁷⁹⁹ 'Proseptic' is merely a quasi-transliteration of the Greek *proslēptikēn*. The adjective *proslēptikos* occurs nowhere else in this kind of context except at Pachymeres *Quadrivium* 2.18.115, where it is plainly a direct borrowing from Porphyry. At this point in the passage which Porphyry is paraphrasing (*Harm.* 55.24) I follow Düring in reading *proslēptikēn*, which I translate (following Solomon (1999) as 'anticipated'. But the reading *proslēptikēn* in Porphyry seems to be right, partly because of the echo in Pachymeres, but more significantly because his next phrase, identifying the interval with the tone next to *proslambanomenos*, seems to be designed to explain his unusual adjective (*proslēptikos* and *proslambanomenos* are both derivatives of the same verb, *proslambanein*). By the 'proseptic' interval he means the one connected with *proslambanomenos*.

⁸⁰⁰ Porphyry is not suggesting, of course, that modulation through a tone amounts, by itself, to a modulation of genus. He apparently means that one can simultaneously modulate through a tone and change to a different genus through an interval that is alien to neither of them, since the tone occurs in them all. With the thesis that the systems before and after a modulation should have elements in common cf. Cleon. *Harm.* 205.16–206.2.

⁸⁰¹ Quoted from the lemma (*Harm.* 55.27) with a minor grammatical change. Porphyry has now left the topic of modulation of genus and returned to the broader topic of transition between the disjunct and conjunct systems.

⁸⁰² 'It', the subject of the sentence, is the tone, or the ratio of the tone, conceived both as the one that disjoins tetrachords and as the one through which the system is transposed in this modulation.

- (25) τόνιον. κίνδυνος γοῦν ἐντεῦθεν εἰς τὸ ἀπρόσφορον μεταπεσεῖν. ὥς δ' αὖθις σύμμετρος διὰ τὸ μήτε μεγάλας, μήτε βραχείας ἐκβάσεις τοῦ μέλους ποιεῖν πρῶτος εἰς ἐμμέλειαν τοῦ γενησομένου τετραχόρδου συνιστάμενος. καὶ κίνδυνός ἐστι, μὴ τὸ μέλος παραφθαρεῖη μὴ σύμμετρον ὄν μεγέθους καὶ βραχύτης· δυσδιάκριτός ἐστι ταῖς ἀκοαῖς ἡ ἐξαλλαγή τοῦ μέλους, καὶ γίνονται ἐντεῦθεν τρία τετράχορδα κατὰ τὸ ἐξῆς
- (30) συνημμένα καὶ μεῖζις τις μερικὴ δύο διεζευγμένων συστημάτων, οἷον ἀποκοπή τις μέρους ἀφ' ἑνὸς τῶν δύο διὰ πασῶν διαστημάτων. πρόκειται γὰρ συντιθέμενον ἢ τῷ ὀξεῖ διὰ πασῶν ἀπὸ τοῦ βαρέος τὸ ὀξύτερον ἢ τῷ βαρεῖ διὰ πασῶν ἀπὸ τοῦ ὀξέος τὸ βαρύτερον. διαφέρουσι δ' ἀλλήλων τὰ τρία κατὰ τὸν τόνον τὴν διὰ τεσσάρων ὑπεροχὴν. ἐπειδὴ
- (35) γὰρ τέσσαρες ἐστῶτές εἰσι τῶν τριῶν τετραχόρδων χωρὶς τοῦ ἐστῶτος προσλαμβανομένου, τέσσαρες ἐστῶτές εἰσιν ἢ τε ὑπάτη τῶν ὑπάτων
- (171) καὶ ἡ τῶν μέσων ὑπάτη, ἢ τε μέση καὶ ἡ νήτη τῶν συνημμένων, τῷ διὰ τεσσάρων ἀλλήλων αὐτὰ διαφέρουσι.

ἐπεὶ δὲ οὐδὲ οὐ προεκεκόφει τοῖς παλαιοῖς ἡ μέχρι τούτων παραύξησις τῶν τόνων—μόνους γὰρ ᾗδισαν τόν τε δῶριον [5] καὶ τὸν φρύγιον καὶ τὸν λυδίων ἐνὶ τόνῳ διαφέροντας ἀλλήλων, ὥς μὴ φθάνειν ἐπὶ τὸν τῷ διὰ τεσσάρων ὀξύτερον ἢ βαρύτερον—καὶ οὐκ ἔχοντες, ὅπως ἀπὸ τῶν διεζευγμένων ποιήσωσιν ἐφεξῆς τρία τετράχορδα, συστήματος ὀνόματι περιέλαβον τὸ συνημμένον, ἵν' ἔχωσι πρόχειρον τὴν ἐκκειμένην μεταβολήν. [10]

- (4) Ἐπειδὴ δ' οἱ παλαιοὶ μόνους ἔτι τῶν τόνων ᾗδισαν τόν τε δῶριον

note of the higher tetrachord.⁸⁰³ There is indeed a risk of lapsing at this point into something disagreeable; but by | being well proportioned <it alters the melody agreeably> because it makes the transitions of the melody neither large nor very small when it is the first <ratio> constructed in the creation of the melodic sequence of the tetrachord that will be formed.⁸⁰⁴ The risk is that the melody may be ruined by not being well proportioned in respect of largeness and smallness – such an alteration of the melody is difficult for the ear to distinguish.

From this there arise three tetrachords | conjoined in sequence, and a partial mixture of two disjunct *systemata*, cutting off, as it were, a part from one of the two double-octave intervals; for either the higher part of the low octave is added in combination with the high octave, or the lower part of the high octave is added in combination with the low octave. The three tetrachords differ from one another in *tonos* by the excess of a fourth;⁸⁰⁵ for since | there are four fixed notes in the three tetrachords, leaving out the fixed note *proslambanomenos*, and the four fixed notes are *hypatē hypatōn*, *hypatē mesōn*, *mesē* and *nētē synēmmenōn*, they differ from one another by a fourth.

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But since the ancients' augmentation of the *tonoi* had not advanced this far – for they knew only the Dorian and the Phrygian and the Lydian, which differ from one another by one tone, so that they could not reach a *tonos* which was higher or lower by a fourth – and since they had no way of making three successive conjunct tetrachords from the disjunct *systemata*, they adopted the conjunct structure and gave it the name *systema* too, so that they might have the modulation set out above ready to hand. Ptol. *Harm.* 56.4–10

⁸⁰³ Here as quite often in Porphyry, the comparative forms of adjectives have superlative force, and I have translated them accordingly.

⁸⁰⁴ The implied subject of the last clause is still 'the tone' or 'the ratio of the tone'. The clause does not directly echo its apparent counterpart in Ptolemy, 'in accordance with its constitution as the first of the melodic'; Ptolemy is alluding to the status of the tone as such, whereas Porphyry focuses specifically on its role in the production of the tetrachord in question. 'Melodic sequence' represents *emmeleia*, literally 'melodic-ness'.

⁸⁰⁵ That is, each tetrachord in the conjunct system is a fourth above or below the next. Porphyry's use of the term *hyperochē*, 'excess', to refer to the interval by which a structure such as a tetrachord, taken as a whole, is higher or lower in pitch than another, is not identical with any of those that appear in earlier passages; it reappears at 173.29 below. It has some affinity with the usage I have called 'Aristoxenian' (see n. 575 above), but it is not exactly the same. Porphyry's statement makes sense only if he is using *tonos* here in the sense 'pitch', rather than 'key'. What he says here and in the rest of the sentence is true, but it seems to reflect a misunderstanding of Ptolemy's statement at *Harm.* 56.1–4 (at the end of the lemma above). Ptolemy is saying that one can shift between the disjunct and the conjunct systems by modulating through a fourth; Porphyry apparently takes him to be repeating the elementary point that the tetrachords in the conjunct system are a fourth apart.

- (5) καὶ τὸν Φρύγιον καὶ τὸν Λύδιον ἀλλήλων διαφέροντας τόνῳ, καὶ οὐ προεκεκόφει ἢ τούτων παραύξεις, ὥστε καὶ τῷ ἐπιτρίτῳ διαφέρειν ἀλλήλων τοὺς τόνους τούτους τῶν τετραχόρδων, θέλοντες ἐφεξῆς ταῦτα συστήσασθαι, ἐπειδὴ ἐκ τῆς διαζεύξεως τοῦ τόνου ἐκωλύοντο ἐφεξῆς τὰ τρία συστήσασθαι, ὠνόμασαν σύστημα ὡσανεὶ γε τέλειον τὸ τῶν συνημμένων τοῦτο σύστημα, ἵνα πρόχειρον ἔχωσι τὴν μεταβολήν.

καθόλου μέντοι γε ἐπὶ τῶν τόνων τῶν τῷ [10]

διὰ τεσσάρων ὑπερεχόντων ἀλλήλων, <ἐάν τε τῶν πρὸ τῆς ὁμοίας διαζεύξεως ἐν ἑκατέρῳ τετραχόρδῳ τὸ τοῦ ὀξυτέρου συναφθῇ τῷ τοῦ βαρυτέρου ἐπὶ τὸ ὀξύ, ποιῇ ἐν τῷ βαρυτέρῳ τρία τετράχορδα συνημμένα, ὣν τὸ μετενεχθὲν γίνεται ὀξύτατον, ἐάν τε τῶν μετὰ τὴν ὁμοίαν διάζευξιν τετραχόρδων τὸ τοῦ βαρυτέρου συναφθῇ τῷ τοῦ ὀξυτέρου ἐπὶ [15] τὸ βαρὺ, ποιῇ πάλιν ἐν τῷ ὀξυτέρῳ τρία τετράχορδα συνημμένα, ὣν τὸ μετενεχθὲν γίνεται βαρύτατον.>

- (13) Καθόλου τοῦτο φησιν ἐπὶ τῶν τόνων τῶν διαφερόντων ἀλλήλων κατ' ἐπίτритον λόγον, ὥστ' ὑπερηχεῖν τοὺς ἄκρους καὶ ἐστῶτας τῶν τετραχόρδων τὸν ὀξύτερον πρὸς τὸν βαρύτερον κατ' ἐπίτритον λόγον, ὅτι ἐπὶ τοῦ διαζευκτικοῦ τόνου, ὃν ὁμοίαν λέγει διάζευξιν ὡς κοινὸν τῶν παρ' ἑκάτερα δύο τετραχόρδων καὶ δύο κειμένων τῶν τοιοῦτων τεσσάρων τετραχόρδων ἐφ' ἑκάτερα, ἥ τὰ δύο βαρύτερα σῶζεται καὶ ἀφαιρεθείσης τῆς διαζεύξεως ἐπισυνάπτεται ἐν τῶν δύο ὀξυτέρων καὶ γίνονται ἐφεξῆς
- (20) τρία, ὣν τὸ ἐπισυναφθὲν ὀξύτερον, ἥ τῶν ὀξυτέρων δύο τετραχόρδων μενόντων ἐπισυνάπτεται τούτοις ἐν ἀπὸ τῶν δύο βαρυτέρων τετραχόρδων τῆς διαζεύξεως ἀφαιρεθείσης, καὶ οὕτω πάλιν ἐφεξῆς τρία συνίστανται τετράχορδα, ὣν τὸ ἐπισυναφθὲν βαρύτερον, καθ' ὥς καὶ ἐπὶ τῆς προκειμένης καταγραφῆς δείκνυσιν ἐπισυνάπτων τοῖς δυσὶ τετραχόρδοις
- (25) τὸ ἐν, ὡς πρόσφορον γίνεσθαι τὴν συναφήν, εἴτε κατὰ τὸν βαρύτατον τόπον, εἴτε μὴν κατὰ τὸν ὀξύτατον· ἀμφοτέρως γὰρ συνάπτεσθαι πέφυκεν.

Ἔστω γάρ ἀπὸ τοῦ Α ὀξυτάτου φθόγγου τετράχορδον ἐπὶ τὸ βαρὺ τὸ ΑΒ καὶ ἕτερον αὐτῷ συνημμένον τὸ ΒΓ <καὶ τόνος ἐφεξῆς διαζευκτικός ὁ ΓΔ καὶ πάλιν ὑπ' αὐτὸν ἕτερα δύο τετράχορδα συνημμένα τὸ τε ΔΕ καὶ [20] τὸ ΕΖ. εἰλήφθω δὲ τοῦ μὲν ὀξυτέρου τῷ διὰ τεσσάρων τόνου ἢ μὲν ὁμοία τῇ ΓΔ διάζευξις [διὰ τεσσάρων] ἢ ΗΘ, συνημμένα δ' αὐτῇ πρὸς τὸ βαρὺ

7 τοὺτους om. G 18 σῶζονται G

in lemma^{prim.} 56.10 τῷ Alexanderson τὸ codd. Ptol. et Porph. addidi

in lemma^{sec.} 56.19–57.9 c Ptol. addidi

11–17 <ἐάν – βαρύτατον> c Ptol.

22 [διὰ τεσσάρων] del. Düring

Since the only *tonoi* the ancients knew were the Dorian | and the Phrygian and the Lydian, which differ from one another by a tone, and the augmentation of the *tonoi* had not advanced so far as to make these *tonoi* of the tetrachords differ from one another by an epitritic, when they wanted to construct these <tetrachords> successively – being prevented by the disjunction from constructing the three successively – they gave the name *systema* to this *systema synēmmenōn*, as though it were indeed | a complete *systema*, so that they might have the modulation ready to hand.

In general, indeed, where there are *tonoi* exceeding one another by a fourth, <if, of the tetrachords before the disjunction which is similar in each, that of the higher [sc. *tonos*] is conjoined with the upper end of that of the lower, it will make three conjoined tetrachords in the lower, of which the highest is the one that has been brought across; and if, of the tetrachords after the similar disjunction, that of the lower is conjoined with the lower end of the higher, this again makes three conjoined tetrachords in the higher, of which the one brought across is the lowest.> Ptol. *Harm.* 56.10–17

In general, on the subject of the *tonoi* that differ from one another in epitritic ratio, so that the higher of the extreme, fixed notes of the tetrachords | exceeds the lower in epitritic ratio, he says that in relation to the disjunctive tone (which he calls the ‘similar disjunction’ because it is common to the pairs of two tetrachords on either side of it, the four tetrachords lying in each direction from it), either the two lower tetrachords are retained and when the disjunction has been removed one of the higher tetrachords is joined on in conjunction, and there come to be | three in succession of which the one joined on is the highest, or else the two higher tetrachords remain and one of the two lower tetrachords is joined on in conjunction, when the disjunction has been removed, and in this way again three tetrachords are constructed in succession, of which the one joined on is the lowest. This corresponds to the way in which, in the diagram he provides,⁸⁰⁶ by attaching in conjunction the one tetrachord to the two | he shows how the conjunction becomes agreeable, whether it is in the lower region or the higher; for a conjunction can be formed in either way.

For let there be a tetrachord, AB, taken downwards from A, its highest note, then another conjoined with it, BC, <next a tone of disjunction, CD, and again below it two other tetrachords in conjunction, DE and EZ. Of the *tonos* that is higher by a fourth let there be taken HF, the disjunction corresponding to CD, and in conjunction with it below, two other tetrachords, FK and KL. Of the *tonos* that is lower by a fourth in

⁸⁰⁶ Ptolemy's diagram follows *Harm.* 56.25, in the passage quoted in the next lemma.

δύο πάλιν τετράχορδα τό τε ΘΚ καὶ τὸ ΚΛ, τοῦ δὲ τῶ διὰ τεσσάρων βαρυτέρου τόνου πρὸς τὸν πρῶτον ἢ μὲν ὁμοία διάζευξις τῇ ΓΔ ἢ ΜΝ, συνημμένα δ' αὐτῇ πρὸς τὸ ὀξύ δύο τετράχορδα τό τε ΝΞ καὶ τὸ ΞΟ. [25]

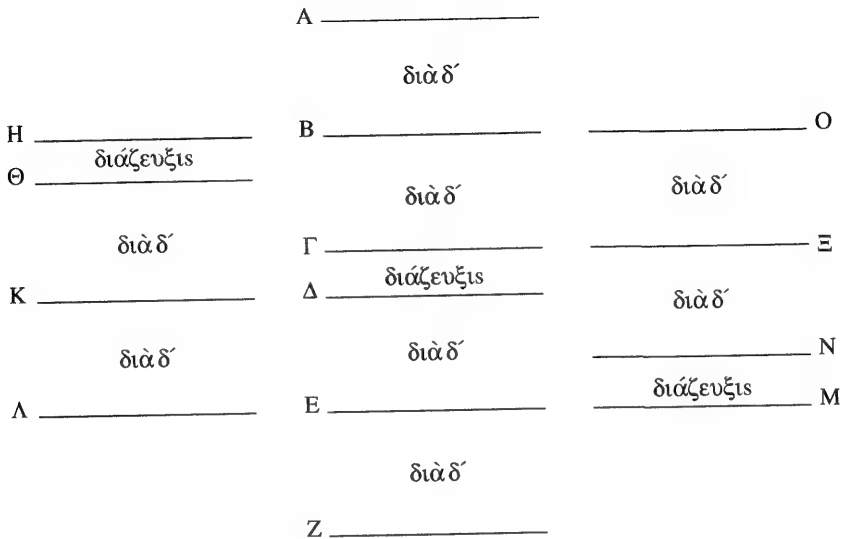


Figure 15G

ἐπεὶ τοίνυν ὁ Θ φθόγγος ὁμοίος ἐστὶ τῶ Δ, ὀξύτερος ἔσται αὐτοῦ τῶ [57] διὰ τεσσάρων—ἐστὶ δὲ καὶ τοῦ Κ ὀξύτερος τῶ αὐτῶ—ισότονοι ἄρα εἰσὶν ὁ τε Δ καὶ ὁ Κ, ὥστε δυνατόν ἔσται συναφθῆναι τῶ Δ ἐπὶ τὸ ὀξύ τὸ ΚΘ τετράχορδον καὶ ποιῆσαι τρία ἐφεξῆς ἐν τῶ ΑΖ τόνῳ τετράχορδα, ὧν αὐτὸ ἔσται ὀξύτατον, τὰ ΖΕ καὶ ΕΔ καὶ ΔΘ. πάλιν ἐπειδὴ ὁ Ν φθόγγος ὁμοίος ἐστὶ τῶ Γ, βαρύτερος ἔσται αὐτοῦ τῶ διὰ τεσσάρων— [5] ἐστὶ δὲ καὶ τοῦ Ξ βαρύτερος τῶ αὐτῶ—ισότονοι ἄρα εἰσὶν ὁ τε Γ καὶ ὁ Ξ, ὥστε δυνατόν ἔσται συναφθῆναι τῶ Γ ἐπὶ τὸ βαρὺ τὸ ΞΝ τετράχορδον καὶ ποιῆσαι πάλιν τρία ἐφεξῆς ἐν τῶ ΑΖ τόνῳ τετράχορδα, ὧν αὐτὸ ἔσται βαρύτερον, τὰ ΑΒ καὶ ΒΓ καὶ ΓΝ.>

- (172) Τίθησι τετράχορδον ὀξύτατον τὸ ΑΒ καὶ ἕτερον αὐτῶ συνημμένον ἐπὶ τὸ βαρὺ τὸ ΒΓ, καὶ τόνον ἐφεξῆς διαζευκτικὸν τὸν ΓΔ καὶ αὐθις ὑπὸ τοῦτον καὶ μετὰ τοῦτον ἐπὶ τὸ βαρύτερον δηλονότι—τὸ γὰρ ἐπὶ τὸ ὀξύτερον πρὸ τούτου καλεῖ—ἄλλα δύο τετράχορδα συνημμένα τό τε ΔΕ
- (5) καὶ τὸ ΕΖ. κέῖται τοίνυν τὸ ὀξύτατον τετράχορδον, οὗ ὁ ἡγούμενος τὸ Α, μεθ' ὃ ἡ τούτου διάζευξις ἐπὶ τὸ βαρύτερον ἢ ΗΘ· ἥς ὁ ἄκρος τοῦ

relation to the first, let there be taken MN, the disjunction corresponding to CD, and in conjunction with it above, two tetrachords NX and XO.

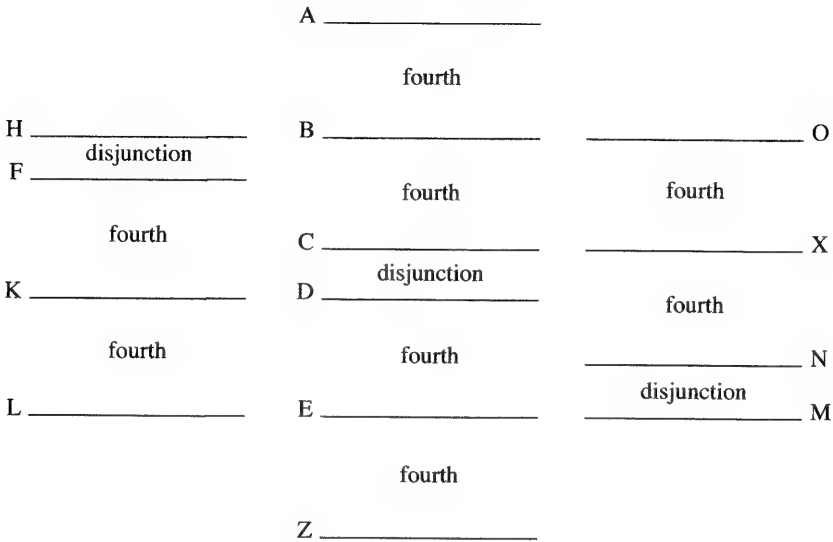


Figure 15

Since then the note F is the counterpart of D, it will be higher than it by a fourth, and it is higher than K by the same amount. Hence D and K are of equal pitch, so that it will be possible to conjoin the tetrachord KF with D on D's upper side, and to make three tetrachords successive in the *tonos* AZ, of which this one will be the highest; they are ZE, ED and DF. Again, since note N is the counterpart of C, it will be lower than it by a fourth, and it is lower than X by the same amount. Hence C and X are of equal pitch, so that it will be possible to conjoin the tetrachord XN with C on C's lower side, and again to make three successive tetrachords in the *tonos* AZ, of which this one is the lowest; they are AB, BC and CN. > Ptol. *Harm.* 56.18–57.9

He sets down a highest tetrachord, AB, and another, BC, conjoined with it below, and next a disjunctive tone, CD, and again below this and after it – for he describes what is higher as 'before' it – two more tetrachords in conjunction, DE | and EZ. Thus there is the highest tetrachord, whose leading note is A, and after it on the lower side its disjunction, HF,⁸⁰⁷ which [172D]

⁸⁰⁷ Porphyry's presentation takes an unexpected form. Instead of introducing this disjunction, HF, explicitly as part of another *tonos*, as Ptolemy does, and then explaining its relation to the pitches of the original *tonos* (in which the notes H and F, as such, do not occur), he fits it directly into its pitch-position in the latter. This mode of exposition is mildly confusing, but generates the right results.

- τετραχόρδου τῷ διὰ τεσσάρων ὑπερέχει. καὶ ταύτῃ τῇ διαζεύξει συνημμένα ἐπὶ τὸ βαρὺ κεῖνται δύο τετράχορδα, τὸ τε ΘΚ καὶ ΚΛ. καὶ αὐτῆς κεῖται ὁ βαρύτερος τόνος οὗ ὁ Ζ ἐπόμενος, ὁ δὲ Ε ἡγούμενος, οὕτινος
- (10) ὁξυτέρα ἐν τῷ ἐπιτρίτῳ λόγῳ ἢ ὁμοία τῇ ΓΔ διαζεύξει διάζευξις ἢ ΜΝ. βαρύτερος γὰρ ὁ τόνος τῆς διαζεύξεως ταύτης. ἔχει δὲ καὶ αὕτη συνημμένα πρὸς τὸ ὁξύ δύο τετράχορδα, τὸ τε ΝΞ καὶ τὸ ΞΟ. καὶ ἐντεῦθεν κατασκευάζει, πῶς τὰ τρία ἅμα συνάπτονται ἁλλοιωθείσης τῆς ΓΔ διαζεύξεως καὶ μενόντων τῶν παρ' ἐκάτερα ταύτης ἐτέρων δύο διαζεύ-
- (15) ξεων πλήν οὐχ ἅμα, ἀλλ' ὅτε μὲν ἐπὶ τὸ βαρὺ συνάπτεται τὸ τετράχορδον τοῖς δυσὶν ὁξυτέροις, μένει ἢ τοῦ βαρυτέρου τόνου διάζευξις ἢ ΜΝ· μέχρι γὰρ τούτου τὰ τρία συνάπτονται ἁλλοιωθείσης τῆς ΘΗ διαζεύξεως· ὅτε δ' ἐπὶ τὸ ὁξύ συνάπτεται τετράχορδον τοῖς δυσὶ βαρυτέροις, μένει μὲν ἢ τοῦ ὁξυτέρου τετραχόρδου διάζευξις ἢ ΗΘ διαζευγνύουσα
- (20) ἐπὶ τὸ βαρὺ τὰ τρία ἅμα τετράχορδα συνημμένα. ἁλλοιοῦται δ' ἢ τοῦ βαρυτέρου διάζευξις ἢ ΜΝ.

- Ἐπεὶ τοίνυν, φησὶν, ὁ Θ φθόγγος, ὃς ἦν ἐπὶ ἡ' πρὸς τὸν Η—ὁ γὰρ ΘΗ τόνος διαζευκτικός ἦν—ὁμοίός ἐστι τῷ Δ, καὶ γὰρ καὶ ὁ Δ φθόγγος πρὸς τὸν Γ τὸ ἐπὶ ἡ' εἶχεν· ἐκ τοῦ Θ δὲ μέχρι τοῦ Δ διὰ τεσσάρων
- (25) τετράχορδον ἦν· ὁξύτερός ἐστιν ὁ Θ τοῦ Δ τῷ διὰ τεσσάρων. ἔστι δὲ καὶ τοῦ Κ ὁξύτερος τῷ αὐτῷ ἐπὶ γ'. ἰσότονοι ἄρ' εἰσὶν ὁ Δ καὶ ὁ Κ, ὧν ἀμφοτέρων ὁξύτερος ὁ Θ φθόγγος τῷ ἐπὶ γ' λόγῳ, ὥστε δυνατόν ἔσται συναφθῆναι τῷ Δ ἐπὶ τὸ ὁξύ τὸ ΚΘ τετράχορδον καὶ ποιῆσαι τρία ἐφεξῆς ἐν τῷ ΑΖ τόνῳ τετράχορδα, ὧν ἐστι τὸ προστεθὲν ὁξύτερον, τὸ
- (30) ΖΕ δηλονότι καὶ τὸ ΕΔ καὶ τὸ ΔΘ. ἡλλοιώθη γὰρ ὁ μέσος διαζευκτικός

the upper boundary of the tetrachord exceeds by a fourth. Conjoined with this disjunction on its lower side are two tetrachords, FK and KL. And again there is the lower *tonos*, of which Z is the 'following' note and E the leading note,⁸⁰⁸ than which | the disjunction MN, corresponding to the disjunction CD, is higher in epitritie ratio; for the *tonos* of this disjunction is lower.⁸⁰⁹ This disjunction also has two conjoined tetrachords above it, NX and XO. And from this Ptolemy establishes how the three tetrachords are conjoined. When the disjunction CD is excluded, there remain on either side of it the two other disjunctions, | but not both of them at the same time. Instead, when the tetrachord is conjoined below the two higher tetrachords, there remains the disjunction of the lower *tonos*, MN, for the three tetrachords are conjoined until they reach it, and the disjunction FH is excluded; but when a tetrachord is conjoined above the two lower ones, there remains the disjunction of the higher tetrachord, HE, which disjoins, | on its lower side, the three tetrachords conjoined together, while the disjunction of the lower *tonos*, MN, is excluded.⁸¹⁰

Thus, he says, since the note F, which was in the ratio 9:8 with H (for FH was a disjunctive tone), is the counterpart of D (for indeed the note D was in the ratio 9:8 with C); and since from F to D was a tetrachord | spanning a fourth, so that F is higher than D by a fourth; and since it is also higher than K in the same ratio, 4:3, it follows that D and K are of equal pitch, since the note F is higher than both of them in the ratio 4:3. Hence it is possible for the tetrachord KF to be conjoined with D on D's lower side, and to make three conjoined tetrachords in the *tonos* AZ, of which the added one is the highest; | clearly they are ZE, ED and DF.⁸¹¹ For the disjunction in the middle has been excluded, and has become the

⁸⁰⁸ Z and E are more strictly the lowest and highest notes of a tetrachord in a *tonos*, not simply of a *tonos*. Here Porphyry's strategy, as when he introduced HE, is to attach the new structure directly to the original. But his presentation is different. Whereas he used the letters assigned to notes in the *tonos* higher than the original to refer to the disjunction HE, he now uses letters, Z and E, which designate notes in the original *tonos*, to identify the boundaries of a tetrachord in the lower *tonos*. Ptolemy refers to the note at the same pitch as E by the letter M, and does not mention a counterpart to Z in this lower system.

⁸⁰⁹ I.e. lower than the corresponding disjunction in the original system, in which the lower note of the disjunction is higher than that of ZE by two fourths. It is not clear whether 'the *tonos* of this disjunction' refers to its key (or pitch), or means 'the interval of a tone that constitutes this disjunction'; but the ambiguity does not affect the point being made.

⁸¹⁰ Ptolemy says nothing about the disjunctions that 'remain' at one end or the other of the three conjoined tetrachords, but one can follow the train of Porphyry's reasoning with the help of Ptolemy's diagram.

⁸¹¹ Porphyry follows Ptolemy in giving the name DF to the tetrachord called KF above. It has been shown that D and K are at the same pitch, and it makes sense to call the tetrachord DF here, since it has now been conjoined with ED. The same applies to XN and CN at the end of the passage.

καὶ γέγονεν ἐπόμενος τοῦ ὀξυτάτου τετραχόρδου τοῦ καὶ ἐπισυναφθέντος. ὃν γὰρ λόγον ἔχει ὁ Θ πρὸς τὸν Κ, τὸν αὐτὸν ἔχει καὶ πρὸς τὸν Δ, ἐπὶ γ' γὰρ ὥσθ' ἴστασθαι τὰ τρία μέχρι τῆς ὀξυτέρας διαζεύξεως τῆς ΘΗ. πάλιν ἐπειδὴ ὁ Ν φθόγγος ὁμοίός ἐστι τῷ Γ, ἐπὶ η' γὰρ καὶ οὗτος κάκεϊ-
 (35) νος, ὁ μὲν τοῦ Μ, ὁ δὲ τοῦ Δ, καὶ βαρύτερός ἐστιν ὁ Ν τοῦ Γ τῷ διὰ τεσσάρων· βαρύτερός ἐστι καὶ τοῦ Ξ τῷ αὐτῷ· ἰσότονοι ἄρ' εἰσὶν ὁ τε Γ

- (173) αὶ ὁ Ξ· ὥστε δυνατόν ἐστι συναφθῆναι τῷ Γ ἡγουν τοῖς δυσὶν ὀξυτέροις τετραχόρδοις ἐπὶ τὸ βαρὺ τὸ ΞΝ καὶ ποιῆσαι πάλιν τρία ἐφεξῆς ἐν τῷ ΑΖ τόνῳ τετράχορδα, ὧν αὐτὸ ἔσται βαρύτατον, τὰ ΑΒ καὶ ΒΓ καὶ ΓΝ.

ζ'

[57.10] Ὅτι μὲν οὖν παρακειμένης τοῖς διεzeugμένοις τελείοις συστήμασι τῆς κατὰ τὸ διὰ τεσσάρων παραβολῆς παρέλκει τὸ συνημμένον σύστημα μετὰ τοῦ μηδὲ τὴν τοῦ τελείου φύσιν ὡς εἴπομεν ἔχειν, διὰ τοῦτο γεγενέτω δῆλον. διοριστέον δὲ πάλιν, ὅτι τῶν καθ' ὅλας συστάσεις γινομένων μεταβολῶν, ἃς καλοῦμεν ἰδίως τόνους παρὰ τῇ τάσει λαμβάνειν τὰς διαφοράς, δυνάμει μὲν ἁπειρόν ἐστι τὸ πλήθος, ὥσπερ [15] καὶ τὸ τῶν φθόγγων—μόνῳ γὰρ διαφέρει φθόγγου ὁ οὕτω λεγόμενος τόνος τῷ σύνθετος εἶναι παρ' ἐκείνον ἀσύνθετον, καθάπερ γραμμὴ παρὰ σημεῖον, οὐδενὸς οὐδὲ ἐνταῦθα κωλύσοντος, ἐάν τε τὸ σημεῖον μόνον, ἐάν τε τὴν ὅλην γραμμὴν μεταφέρωμεν ἐπὶ τοὺς συνεχεῖς τόπους—ἐνεργεία δὲ τῇ πρὸς τὴν αἴσθησιν ὠρισμένον, ἐπειδὴ καὶ τὸ τῶν φθόγγων. [20] διὸ καὶ τρεῖς ἂν εἴεν ὅροι τῶν περὶ τοὺς τόνους θεωρουμένων, ὡς ἐφ' ἐκάστης τῶν συμφωνιῶν, πρῶτος μὲν καθ' ὃν ὁ τῶν ἄκρων τόνων λόγος συνίσταται, δεύτερος δὲ καθ' ὃν τὸ πλήθος τῶν μεταξύ τῶν ἄκρων, τρίτος δὲ καθ' ὃν αἱ πρὸς ἀλλήλους ὑπεροχαὶ τῶν ἐφεξῆς, καθάπερ ἐπὶ τοῦ διὰ τεσσάρων φέρε εἰπεῖν, ὅτι τε τὸν ἐπίτριτον ποιούσι λόγον οἱ [25] ἄκροι τῶν φθόγγων καὶ ὅτι μόνον τρεῖς οἱ συντιθέντες τὸν ὅλον καὶ ὅτι τοιαῖδε αἱ τῶν λόγων διαφοραί,

- (7) Ὅτι μὲν οὖν, φησὶν, ἐπειδὴ τέλειόν ἐστι σύστημα τὸ διεzeugμένον καὶ ἀμετάβολον, εἴ τις τὸ διὰ τεσσάρων τούτῳ παραβάλοι καὶ τὸ συνημ-

4 τέλος τοῦ ζ' κεφ.: ἀρχὴ τοῦ ζ' κεφ. add. p

in lemmate: 57.10 παρακειμένοις p

'following' note of the highest tetrachord, the one that was added⁸¹² – for F has the same ratio to D as it has to K, 4:3 – so that there are three tetrachords extending as far as the higher disjunction, FH. Again, since the note N is the counterpart of C (for both are in the ratio 9:8, | the former with M and the latter with D), since N is lower than C by a fourth and since it is lower than X by the same interval; it follows that C and X are of equal pitch. Hence it is possible for XN to be conjoined with C on C's lower side, that is, with the two higher tetrachords, and to make once again three tetrachords in succession in the *tonos* AZ, of which it⁸¹³ will be the lowest; they are AB, BC and CN.

[173D]

Chapter 7

Let this be enough to show that when there is a shift of a fourth between complete disjunct *systemata*, this makes the conjunct *systema* redundant, in addition to the fact that it does not even have the nature of something complete, as we were saying. It must next be made clear that in the case of modulations that involve shifts in complete structures, to which we give the special name *tonoi* because it is from pitch that they take their differences, the number of them is potentially unlimited, as is that of the notes – for a *tonos*, in this usage, differs from a note only in that it is composite while the other is incomposite, like the difference between a line and a point, where once again nothing prevents us from moving either the point alone or the whole line to the adjacent position – but in the actuality available to the senses it is limited, since that of the notes is so too. Hence there must be three limits applying to features found in the *tonoi*, as there are for each of the concords, the first being that by which the ratio between the outermost *tonoi* is constructed, the second that by which the number of those between the extremes is determined, and the third that by which the excesses between successive *tonoi* are established – just as in the case of the fourth, for instance, where the extreme notes make an epitritic ratio, where there are only three ratios constituting the whole, and where the differences between the ratios are such-and-such. Ptol. *Harm.* 57.10–27

Let it then be clear from this, Ptolemy says, that since the disjunct, changeless *systema* is a complete *systema*, if one shifted through a fourth from it

⁸¹² Porphyry's way of expressing the point is a little odd; the disjunction is an interval, not a note, and it has not 'become' anything in the new structure. Presumably what he means is that the place from which the disjunction began (i.e. its lower boundary) is now occupied by the lowest note of the highest tetrachord. Alternatively, perhaps, since he sometimes uses the note-name *proslambanomenos* to refer to the disjunctive tone lying above it (cf. n. 771 above), he might here have adopted the converse form of reference (using the interval's name instead of the note's), so that the expression *ho mesos diazeuktikos*, 'the disjunction in the middle' refers to the note *mesē*.

⁸¹³ 'It' refers to XN, which reappears as CN a few words later; cf. n. 811 above.

- μένον ποιήσῃσι σύστημα, πρὸς τῷ μὴ ἔχειν αὐτὸ τὴν τοῦ τελείου φύσιν
- (10) —οὐ γὰρ πάντα τὰ εἶδη τοῦ τε διὰ πασῶν καὶ αὐθις τοῦ διὰ πέντε συνεῖχεν, ὡς ἔλεγε πρότερον—πρὸς γοῦν τῷ μὴ ἔχειν τοῦτο τὴν τελειότητα καὶ παρέλκον καὶ περιπετυδόν ἐστιν· οὐδὲν γὰρ πλεον ἐντεῦθεν συνάγεται, ἀλλὰ καὶ μάλλον πόλλ' ἅττα τῶν ἐν τῷ τελείῳ καὶ διεξευγμένῳ συναγομένων ἐλλείπει, ἐντεῦθεν ἔστω δῆλον.
- (15) Νῦν δὲ περὶ τῶν κατὰ τοὺς τόνους μεταβολῶν ῥητέον, οὐδὲ γὰρ περὶ τῶν μεταβολῶν τῶν κατὰ τὸ γένος, οὐδὲ μὴν τῶν κατὰ τὸ μέρος, ἀλλὰ τῶν κατὰ τοὺς τόνους, ἐξ ὧν σύστημα πᾶν συνάγεται, εἰ θέλεις διὰ τεσσάρων, εἰ θέλεις διὰ πέντε, εἰ θέλεις ἄλλο τι. οὗτοι γοῦν οἱ τόνοι φησὶν ἄπειροί εἰσι τῇ ἐπινοήσῃ τὸ πλῆθος κατὰ τὸ ἄπειρον τῶν ἐπιμορίων
- (20) πλῆθος, ἂν τέως ἔλλογοί εἰσιν· οἱ δ' ἄλογοί τε καὶ ἄρρητοι ὑπερέκεινα, καθ' ὡς ἄρα καὶ αἱ τοῦ αὐτοῦ καὶ ἐνὸς φθόγγου παρηγήσεις ἄπειροι. οὐδὲν γὰρ ἄλλο διαφέρει φθόγγος τόνου ἢ ὡς σημεῖον γραμμῆς. ὁ γὰρ φθόγγος μίᾳ χορδῇ ἐστιν, ὁ δὲ τόνος δύο ἢ καὶ πλειόνων. ὥσπερ οὖν ἐκεῖ ἀδιάφορόν ἐστι, καὶ τὸ σημεῖον, καὶ τὴν γραμμὴν εἰς τοὺς συνεχεῖς

and made the conjunct *systema*, in addition to the latter's not having the nature of what is complete | – for it does not contain all the forms of the octave or again of the fifth, as he said before⁸¹⁴ – in addition to not having this completeness it is redundant and unnecessary; for no further form is contained in it, but rather, many of those contained in the complete, disjunct *systema* are left out.⁸¹⁵

| Now we must speak about modulations of the *tonoi* – not about modulations of genus or indeed those of melody, but those of the *tonoi* from which every *systema* is constructed, a *systema* of a fourth, if you like, or a fifth or any other.⁸¹⁶ Abstractly conceived, he says, these *tonoi* are unlimited number, in correspondence with the unlimited number of epimoric ratios, | to the extent that they are rational.⁸¹⁷ (Over and above them there are those that lack ratio and are irrational, just as the *parēchēseis* of one and the same note are also infinite.)⁸¹⁸ For a note differs from a *tonos* in just the same way as a point differs from a line, since a note belongs to one string while a *tonos* belongs to two or more.⁸¹⁹ Hence just as it makes no difference whether we transfer the point or the line into the |

⁸¹⁴ See Ptol. *Harm.* 51.1–12. Porphyry here omits the qualification that the conjunct *systema* does not 'always' contain all the forms of the fifth.

⁸¹⁵ This is a rather inept paraphrase of Ptolemy. The fact that it omits some of the forms of the octave contained in the disjunct *systema* is precisely what makes it incomplete, not a failing additional to its lack of completeness. According to Ptolemy its 'redundancy' as an independent structure is due to its inclusion among the results of acceptable modulations of the complete two-octave system.

⁸¹⁶ Here, as in many contexts, a *tonos* is not simply a key but a complete *systema* in a particular key. Every non-modulating *systema*, as it appears in musical practice, is either a whole *tonos*, in this sense of the word, or else – if it has a smaller range – a segment of one. (In so far as one can designate modulating structures as *systemata*, they are made up from segments of two or more *tonoi*.)

⁸¹⁷ 'Rational' represents *ellogoi*, literally 'in ratios'. If I have construed the phrase rightly it is slightly peculiar, since all epimoric ratios are rational in Porphyry's sense of the word. We might expect the sense 'because all of them are rational', but I cannot see how this can be extracted from the Greek.

⁸¹⁸ The noun *parēchēsis* does not appear elsewhere in musical contexts. It is defined by the grammarians as the use of two or more words which sound similar but have different senses. Porphyry's meaning is not clear. He cannot be exploiting a direct parallel with the grammarians' usage, referring to notes which have the same pitch but differ in function, since the number of functions (*dynamēis*) is limited to 15 (see Ptolemy's treatment in *Harm.* II.5; no writer suggests even the abstract possibility of the existence of others). Perhaps he is drawing on the noun's literal connotation, a 'sounding alongside', and is referring to the resonances set up (in a sound-box, for instance, or in the bell of a wind instrument) around the principal sound, or to random vibrations set up in nearby objects. Just possibly he may have what we call 'overtones' in mind, but that hypothesis is hazardous, since it is uncertain whether the Greeks had a conception of them which is recognisably like our own.

⁸¹⁹ 'While a *tonos* belongs to two or more': this seems to be an attempt at expanding Ptolemy's statement that a *tonos*, like a line, is 'composite' (*synthetos*), by contrast with a note, which like a point is 'incomposite' (*asynthetos*). Clearly this is related only indirectly to the fact that a *tonos* requires several strings if it is to be expressed in sound. Ptolemy seems once again to be thinking within an Aristoxenian framework, in which the compass of a *tonos* is a distance along something analogous to a continuous line, marked off into intervals (and so made 'composite') by notes which like points have no dimensions.

- (25) τόπους μεταφέρωμεν, οὕτω καὶ ἐνταῦθα τὸ κατὰ τὸ συνεχές πλῆθος τῶν τοιοῦτων ἐμφαίνεται. ἐνεργεία δὲ καὶ πρὸς τὴν αἴσθησιν ὠρισμένοι εἰσί, καὶ τέως ἐφ' ἐκάστης συμφωνίας τρεῖς εἰσιν οἱ τῶν τόνων ὄροι, εἷς ὁ τῶν ἄκρων, δεύτερος ὁπόσον τὸ πλῆθος τῶν μεταξύ τῶν ἄκρων, καὶ τρίτος, καθ' ὃν ὑπάρχουσιν αἱ ὑπεροχαὶ τῶν ἐφεξῆς ἢ κατὰ δίεσιν ἢ καθ' ἡμιτόνιον ἢ κατὰ τινα ἐπιμόριον ἄλλον.
- (30)
- (174) πλὴν καθ' ὅσον τούτων μὲν τῶν ὄρων [27] ἕκαστος ἴδιον ἔχει τὸ αἶτιον, ἐπὶ δὲ τῶν τόνων ἔπονται πως <τῷ πρώτῳ τῶν ὄρων οἱ λοιποὶ δύο μῖς καὶ τῆς αὐτῆς ἐχόμενοι παραφυλακῆς, ἧς τὸ ἀκόλουθον ἀγνοήσαντες οἱ πλεῖστοι διαφόρως ἕκαστον ἐκτίθενται [30] [58] τῶν ὄρων, οἱ μὲν ἐπ' ἐλάττονα τοῦ διὰ πασῶν φθάσαντες, οἱ δ' ἐπ' αὐτὸ μόνον, οἱ δὲ ἐπὶ μείζονα τούτου, προκοπὴν τινα σχεδὸν τοιαύτην αἰετῶν νεωτέρων παρὰ τοὺς παλαιότερους θηρωμένων, ἀνοικεῖον τῆς περὶ τὸ ἡρμοσμένον φύσεώς τε καὶ ἀποκαταστάσεως, ἣ μόνῃ περαίνειν ἀναγκαῖόν ἐστι τὴν τῶν ἰσομένων ἄκρων τόνων διάστασιν, ὥς ἂν μήτε [5] τῆς κατὰ τὴν φωνὴν μεταβάσεως ἕνα καὶ τὸν αὐτὸν ἔχειν ὄρον δυναμένης, μήτε τῆς κατ' ἄλλο τι τῶν ποιησάντων τοὺς ψόφους. οὐδὲ γὰρ ἔνεκεν τῶν ὀξυτέρων ἢ βαρυτέρων φωνῶν εὐροιμεν ἂν τὴν σύστασιν τῆς κατὰ τὸν τόνον μεταβολῆς γεγεννημένην—ὁπότε πρὸς τὴν τοιαύτην διαφορὰν ἢ τῶν ὀργάνων ὅλων ἐπίτασις ἢ πάλιν ἄνεσις ἀπαρκεῖ, μηδε- [10] μῖς γε παραλλαγῆς περὶ τὸ μέλος ἀποτελουμένης, ὅταν ὅλον ὁμοίως ὑπὸ τῶν βαρυφωνοτέρων ἢ τῶν ὀξυφωνοτέρων ἀγωνιστῶν διαπεραίνηται—ἀλλ' ἔνεκα τοῦ κατὰ τὴν μίαν φωνὴν τὸ αὐτὸ μέλος ποτὲ μὲν ἀπὸ τῶν ὀξυτέρων τόπων ἀρχόμενον, ποτὲ δὲ ἀπὸ τῶν βαρυτέρων, τροπὴν τινα τοῦ ἡθους ἀποτελεῖν, τῷ μηκέτι πρὸς ἑκάτερα τὰ πέρατα τοῦ μέ- [15] λους συναπαρτίζεσθαι τὰ τῆς φωνῆς ἐν ταῖς τῶν τόνων ἐναλλαγαῖς, ἀλλ' αἰεὶ προκαταλήγειν, ἐπὶ μὲν θάτερα τὸ τῆς φωνῆς πέρας τοῦ τοῦ μέλους, ἐπὶ δὲ τὰ ἐναντία τὸ τοῦ μέλους πέρας τοῦ τῆς φωνῆς, ὥστε τὸ ἐξαρχῆς ἐφαρμόσαν τῇ διαστάσει τῆς φωνῆς, πῇ μὲν ἀπολειπὸν ἐν ταῖς μεταβολαῖς, πῇ δὲ ἐπιλαμβάνον, ἐτέρου ἡθους φαντασίαν παρέχειν ταῖς ἀκοαῖς.> [20]

places continuous with it, so too it evidently is here with the continuous plurality of items such as these. But in the actuality available to the senses they are limited, and like each of the concords the *tonoi* have three limits; one is that of their extremes, the second is the number of those between the extremes, and the third is the one determining the excesses between successive *tonoi*,⁸²⁰ by a diesis or | a half-tone or some other epimoric.⁸²¹

But in that case [sc. that of a concord such as the fourth], each of these limits has its own special basis, whereas in the case of the *tonoi* the other two follow <in a way from the first, strictly guarded by one and the same restriction. Most people, not grasping the consequences of this restriction, set out each of the limits in ways that disagree with one another, some settling on a ratio smaller than the octave, some just on the octave, some on one greater than that. More recent writers have continually hunted out some advance of this kind over their predecessors, a procedure inappropriate to the nature of attunement and its periodicity – by which alone one must determine the interval between what are to be the outermost *tonoi* – on the grounds that the transition of the voice cannot have a single, unvarying limit, and neither can that of anything else that makes sounds. For we shall not find that the construction of modulation of *tonos* exists for the sake of higher and lower voices – as when whole instruments are raised or lowered in pitch, to accommodate that sort of difference, and no alteration in the melody results, or when the whole melody is completed in just the same way by lower-voiced or higher-voiced performers – but it exists in order that the same melody, in the same voice, starting sometimes from a higher position and sometimes from a lower, may produce a change in character (*ethos*). This is achieved, in shifts between *tonoi*, by the voice's limits no longer being attached to those of the melody, but one always ceases before the other, in one direction the limit of the voice occurring before that of the melody, and in the opposite direction that of the melody preceding that of the voice, so that the melody that was originally fitted to the compass of the voice, by falling short of it at one place in the modulations and exceeding it in another, provides for the ear the impression of a different character.> Ptol. *Harm.* 57.27–58.20 [174D]

⁸²⁰ That is, the sizes of the intervals that separate them; cf. 170.34 above with n. 805. In the present passage, but not the previous one, the usage is borrowed from Ptolemy (57.24).

⁸²¹ The awkwardness of Porphyry's routine but strictly inaccurate use of everyday Aristoxenian terminology becomes obtrusive here, since 'a half-tone or some other epimoric' seems to imply that the half-tone is itself in an epimoric ratio. Porphyry is of course well aware that it is not, and in most contexts his use of terms such as 'half-tone' is understandable and harmless. But it seems careless of him to have placed terms from the two incompatible systems side by side, when there was clearly no need to do so. (One could of course argue that the Greek construction does not automatically imply that the half-tone is epimoric; phrases of the type epitomised by the notorious 'Cyrus and the other camels' are common enough, and are to be construed on the lines of 'Cyrus and the others, the camels'. But this would be a very strained interpretation in the present case.)

- (3) Πλήν τῶν ὄρων ἡ διαφορὰ τῆς συμφωνίας πρὸς τοὺς τόνους, ὅτι ἐκείνων μὲν ἕκαστος ἰδιάζον καὶ ἄμεικτον ἔχει τὸ αἴτιον. ἐπὶ μὲν τῶν ἄκρων
- (5) ἢ ἡμιόλιον ἢ ἐπίτριτον ἢ διπλάσιον ἢ τριπλάσιον ἢ τετραπλάσιον. ἐπὶ δὲ τοῦ πλήθους τῶν διαστημάτων ἢ γ' ἢ δ' ἢ ζ' ἢ ια' ἢ ιδ'. ἐπὶ δὲ τῶν λόγων καὶ τῶν ὑπεροχῶν πλείστη ἐστὶν ἡ διαφορὰ πάντως ἐφ' ἑκάστης συμφωνίας· ἐπὶ δὲ τῶν τόνων πρὸς τὸν πρῶτον οἱ λοιποὶ δύο ὡς ἐπὶ τοῦ τετραχόρδου ἀκόλουθοι εἰσι παραπεφυλαγμένοι ἀκριβῶς εἰς τὸ
- (10) μέλος ἐξεργάσασθαι πρόσφορον· ὃ δὲ ἀγνοήσαντες οἱ παλαιοὶ οὐκ ἐφρόντισαν, ἵν' οἱ ἄκροι συνηχώσιν, ἀλλ' οἱ μὲν οὐ φθάνουσι <ἐπὶ> τὸ διὰ πασῶν,
- οἱ δ' ὑπερβαίνουν, οἱ δὲ καὶ οὐ συμφώνους τοὺς ἄκρους καθιστῶσιν, οἱ δ' ἐπ' αὐτὸ τοῦτο φθάνουσι καὶ εὐστοχοῦσι τῆς συμφωνίας τῶν ἄκρων συμπεραίνοντες καὶ συμβιβάζοντες τὴν τῶν ἄκρων τόνων διάστασιν.
- (15) οὐτε γὰρ ἡ ἀνθρωπίνη φωνὴ ἓνα καὶ τὸν αὐτὸν ἔχει τὸν ὄρον τῆς μεταβάσεως, οὐτ' ἄλλο τι τῶν ποιούντων τοὺς ψόφους ὀργάνων. ἡμεῖς δ' οὐχ ἕνεκα μόνον τῶν ὀξυτέρων καὶ βαρυτέρων φωνῶν τὴν κατὰ τῶν τόνων μεταβολὴν ζητοῦμεν—ὡς φέρε γενέσθαι ὀξύτερον μόνον ἢ βαρύτερον τὸ μέλος τοῦ αὐτοῦ ἤθους φυλασσομένου ἀεὶ πρὸς ταῦτα γὰρ ἡ τῶν ὀργάνων ἐπίτασις καὶ ἀνεσις ἀπαρκεῖ, ὅταν ἀποτελεῖται τὸ αὐτὸ μέλος ἢ κατ' ὀξυφωνίαν ἢ κατὰ βαρυφωνίαν—ἀλλὰ ζητοῦμεν καὶ τὴν τοῦ ἤθους μεταβολὴν ποτὲ μὲν ἀρχομένου ἀπὸ τῶν ὀξυτέρων, ποτὲ δ' ἀπὸ τῶν βαρυτέρων, ὅτε οὐ πρὸς ἑκάτερα τὰ μέρη τοῦ μέλους τὰ τῆς φωνῆς συναπαρτί-

3 τῆς συμφωνίας πρὸς τοὺς scripsi πρὸς τοὺς τῆς συμφωνίας codd. II <ἐπὶ> add. Alexanderson
12 ὑπερβαίνουν G 14 τὴν om. p

But there is this difference, he says, between the limits of a concord and those of the *tonoi*, in that each of the former has a basis that is peculiar to it and unmixed.⁸²² In the case of the extremes, | it is hemiolic or epitrititic or double or triple or quadruple;⁸²³ in that of the number of intervals it is 3 or 4 or 7 or 11 or 14; and in the case of the ratios and the excesses there are very many differences in each concord without exception.⁸²⁴ But in the case of the *tonoi*, the other two limits follow from the first, strictly and meticulously guarded [sc. by it], just as they follow in the tetrachord, so as to | produce an agreeable melody.⁸²⁵ But the ancients did not understand this, and took no thought to ensure that the extremes should be concordant; some did not reach as far as the octave and some went beyond it; some even failed to make the extremes concordant, while some did reach this point [sc. the octave] and assessed rightly⁸²⁶ the concordance of the extremes, determining as a consequence⁸²⁷ the distance between the extreme *tonoi*. | For the human voice does not have a single, unvarying limit to its transition, and neither does any of the other instruments that make sounds.⁸²⁸ And we do not look for modulation of the *tonoi* just for the sake of higher and lower voices, so that the melody merely becomes higher or lower while continuing to keep the same character (*ēthos*) – raising and lowering the pitches | of instruments is sufficient for this purpose, when the same melody is produced in high sounds or low ones⁸²⁹ – but we are also looking for modulation of character, beginning sometimes from the higher and sometimes from the lower, when the parts of the vocal sound are not fitted together consistently with each of the two parts of the melody, but

⁸²² I take it that by 'unmixed', *ameikton*, Porphyry means that the 'basis' (literally 'cause') of each of a concord's limits is not combined with the cause of any of its other limits; no limit's cause is involved in determining any of the others, nor is it determined by any other.

⁸²³ Porphyry omits the ratio between the extremes of the octave and a fourth (8:3), which Ptolemy, unlike the Pythagoreans, includes among the concords (e.g. *Harm.* I.6, 13.1–23, with Porph. 104.5–107.5).

⁸²⁴ These ratios and *hyperochai* are not those of the concords themselves, but of the various smaller ratios into which they can be divided; cf. Ptol. 57.26–7 (at the end of the previous lemma).

⁸²⁵ 'Strictly guarded' is a military metaphor borrowed from Ptolemy, 'watched over closely'. The allusion to the tetrachord, which is not in Ptolemy, may refer back to the arguments of I.15, but it is not clear how it is to be understood.

⁸²⁶ The verb is *eustochein*, which may carry the suggestion of 'guessing' correctly – that is, getting the answer right without basing it on solid evidence or reasoning. But it does not always have that implication.

⁸²⁷ I read the phrase *sympereinontes kai symbibazontes* (which might literally mean 'determining and inferring') as a hendiadys, 'determining by inference' – by inference, that is, from the interval they postulated between the highest and lowest *tonoi*.

⁸²⁸ The point is that the distance between the outermost *tonoi* cannot be simply read off from the very variable limits of the pitch-range available to a voice or an instrument.

⁸²⁹ More literally 'with a high or a low voice', *kat'oxypōnian ē kata barypōnian*.

- (25) ζεταί, ἀλλ' αἰὶ προκαταλήγει ἐφ' ἓν μὲν μέρος τυχόν τὸ τῆς φωνῆς τοῦ μέλους, ἐφ' ἓν δὲ τὸ πέρας τοῦ μέλους τῆς φωνῆς· ὥστε τὸ ἀρχῆθεν ἐφαρμόζον τῇ διαστάσει μέλος πῇ μὲν ἀπολεῖπον, πῇ δ' ἐπιλαμβάνον ἑτερότητα τοῦ ἤθους ποιεῖν.

25 ἐφ'] ὑφ' codd.

in one part the limit of the voice is reached before that of the | melody, and in the other the limit of the melody is reached before that of the voice. Thus the melody which was originally fitted to the distance⁸³⁰ falls short of it in one place and exceeds it in another, and hence produces a change in character.⁸³¹

⁸³⁰ The 'distance' is the range which the melody would occupy if it were performed in the same *tonos* throughout. Both Ptolemy and Porphyry write as if there is always a straightforward, non-modulating melody lurking below the surface of one that modulates between *tonoi*; perhaps they even believed that a composer always devises such a melody first, and then goes on to introduce a change of 'character' at some point in its course, by transposing part of it into a different key. In one kind of case the vocal line shifts to a lower key before reaching the highest parts of the subsequent phrases in their unmodulated form, or to a higher key before it reaches their lowest parts, while in the other it modulates in such a way as to extend upwards or downwards the range which these parts of the unmodulated melody would occupy.

⁸³¹ Ptolemy's writing in II.7 is not always easy to understand, but Porphyry's paraphrase is so cramped and awkward in parts as to be barely intelligible. I have done my best to make sense of it while remaining faithful to the text, but am far from sure that I have succeeded. Porphyry's commentary, as we have it, breaks off here, at the end of *Harm.* II.7. There is nothing in its final section to suggest that Porphyry has now completed the task he set himself, nor is there any indication in the opening pages of Book I that he will not examine the *Harmonics* as a whole. But nine chapters of Book II are left untouched, as well as the whole of Book III. See Introduction Section 3.

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